WIRE AND WIRE PRODUCTS

OCTOBER 1953

for 83 years

V® first in Design, Performance, Industry Acceptance

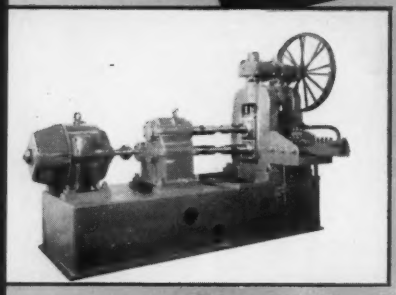
Vaughn®
WIRE DRAWING MACHINERY
"Quick on the Draw!"

see pages 1060A, B, C, & D

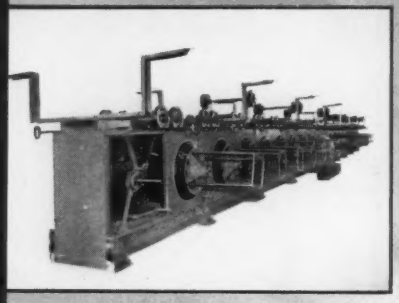
OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

LOOK TO Wean FOR WIRE MACHINERY

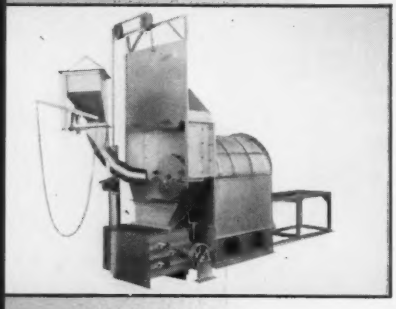
Process OR Product



2—Hi Wire Flattening Mill



Wire Galvanizing Take-Up Frame

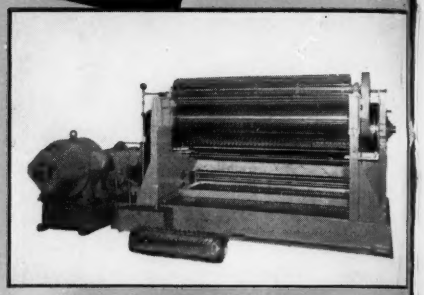


Nail Galvanizing Unit

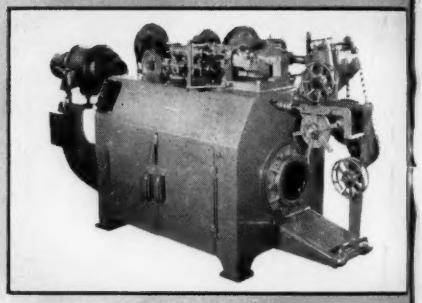
In the past few years tremendous progress has been experienced in the field of wire machinery. Production speeds have been tripled and quadrupled. Product quality has been greatly improved. Machines have been made easier to operate and maintain.

The Wean Equipment Corporation has been a large contributor to this advancement. Wean wire mill specialists have designed, built, and installed wire mill equipment for the leading wire producers the world over. If you make wire you should look to Wean for the best in machinery, service, and facilities.

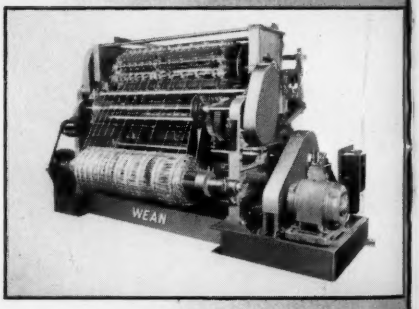
STRIP MACHINERY



Hexagon Netting Machine



2 or 4—Point Barbed Wire Machine



Hinge — Joint Fence Machine

Wean Equipment Corporation
CLEVELAND, OHIO

WHAT DOES FIRTH STERLING OFFER YOU?

(ANSWER NUMBER 3)

UNBIASED RECOMMENDATIONS

Producing *tools* and *tool materials* for the cutting, shaping and forming of metals is *major* business at Firth Sterling. Hence, capacity to serve you best necessarily embraces "full line tooling" . . . high speed tool steels *and* tungsten carbides, or *both* as needed.

So, you can count on *unbiased* tooling recommendations when you make Firth Sterling your *one* source of supply for *complete* shop tooling needs. We have no axes to grind!

What are the advantages to you?

1. An integrated tooling program that saves you money by matching tools to applications, without temptation to apply more expensive tools than may be necessary.
2. Improved production from wider selections. A choice of 97 different grades of high speed steels and tool and die steels *and* a dozen grades of carbides in everything from die nibs to an almost unlimited selection of standard and special carbide tools and tips.
3. The purchasing economies inherent to buying from one source of supply instead of from several.
4. The finest "packaged" tool line today for easy handling, stocking, identification in the tool crib, and inventory control.
5. The consistently high quality assured by 64 years of leadership in development of special purpose steels and 24 years of pioneering in carbide and powder metallurgy applications.

Makes sense, doesn't it? Call a Firth Sterling representative, or phone the nearest one of our 87 distributors.

Firth Sterling Stands for Metallurgical Achievement—Past, Present, Future

I-3

C.H.Q. DIE STEEL

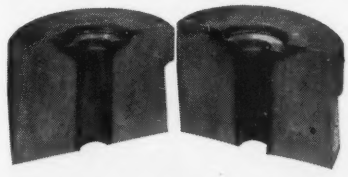
hangs up... **ANOTHER COLD HEADING RECORD IN COMPARATIVE TESTS!**

A nationally known fastener manufacturer* recently made comparative tests of solid steel cold heading dies, under carefully controlled conditions, producing 5/8" square head machine bolts from 1020 steel on a Waterbury Farrel double stroke automatic.

Firth Sterling C.H.Q. came off with top honors and the highest production ever

C. H. Q. solid die after 192,000 run.

obtained by this manufacturer from any steel die . . . 192,045 both ends. (78,860 one end, 59 Rockwell C; 113,185 other end, 61 Rockwell C). Standard competitive carbon steel dies produced only 50,000—60,000 both ends and ultimately failed by cracking axially. The C.H.Q. die wore oversize but longitudinally etched



Longitudinally etched section reveals no cracks.

section revealed not even a hair line crack.

Ask for technical literature on C.H.Q.—or a Firth Sterling representative will discuss your die problems. His recommendations are unbiased . . . we make and sell *both* steel *and* carbide for every tooling need.

*(name on request)

P-10

Firth Sterling
— INC. —

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OFFICES* AND WAREHOUSES: BIRMINGHAM* CHICAGO CLEVELAND DAYTON* DETROIT HARTFORD HOUSTON* LOS ANGELES NEW YORK* PHILADELPHIA* PITTSBURGH* WASHINGTON*

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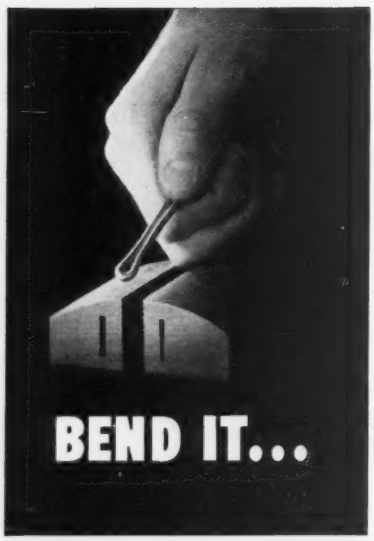
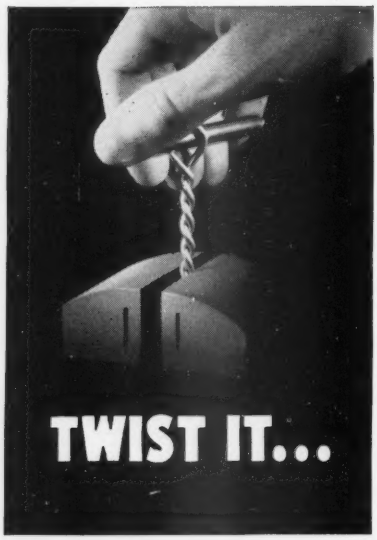
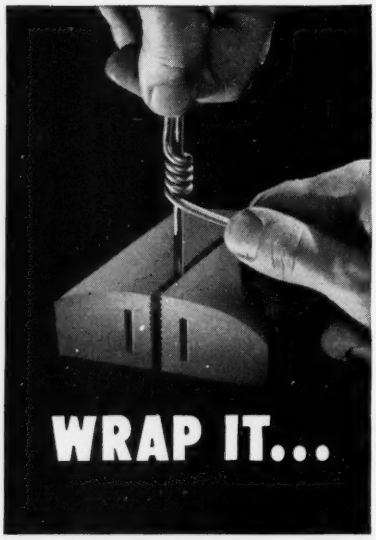
High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets







What makes it hold so tight?

The ductile coating of zinc on bethanized wire is undamaged, even when the wire is wrapped around its own diameter.

Bend a piece of bethanized wire, twist it, wrap it around its own diameter—even draw it to fine gauge—and the zinc coating stays put, without cracking, flaking or peeling off.

What makes the bethanized zinc coating hold to the steel wire so tenaciously? The unique electrolytic bethanizing process deposits virgin zinc on an electrolytically cleaned steel surface. The result is a zinc coating of high purity and exceptional ductility. It's integrally bonded to the steel base, proving that it is not necessary to have an iron-zinc alloy layer as a bonding agent.

Besides withstanding severe forming or fabricating operations, bethanized coatings are available in weights to fit your particular requirements. For example, we can supply a coating thickness much heavier than conventional galvanized coatings.

The two great advantages of the bethanized coating—its ability to withstand severe forming and fight off corrosion—make bethanized the ideal zinc-coated wire for many uses. Perhaps it may be the answer to one of your problems. A letter or phone call to the nearest Bethlehem sales office will bring you full information promptly.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

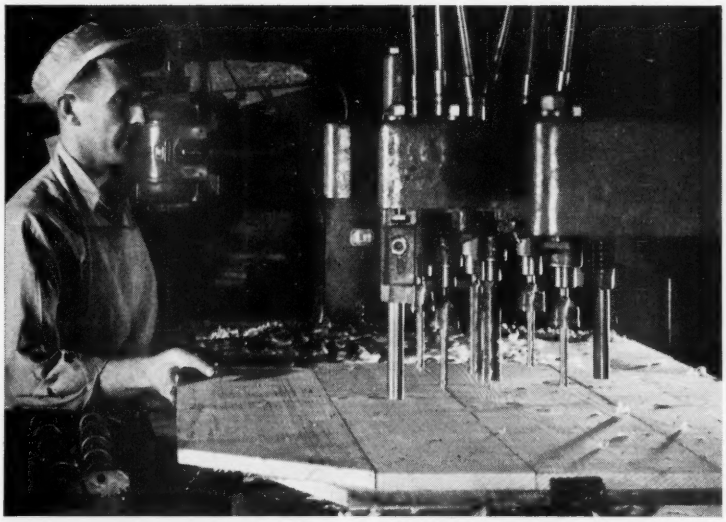
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHANIZED WIRE

Your Reel Specifications Are BRIDGE'S Blue Print



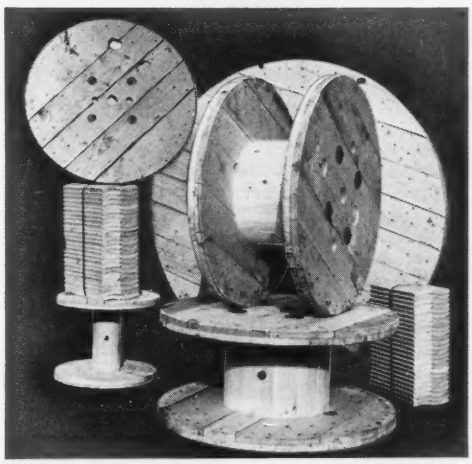
Above: **BORING MACHINE**

WOOD REELS
for
CABLE, ROPE
and
WIRE

ALL SIZES AND TYPES OF SHIPPING AND SHOP REELS

12" to 96" in diameter. Knocked down or assembled. Returnable or non-returnable. Wood heads for steel drums.

REELS made by **BRIDGE** are of precision construction produced for each customer to his own specifications. They are rugged and will withstand severe handling, yet they cost you no more than ordinary reels. Our modern plant, with much equipment specially built for us, together with our straight-line production methods, assure you of the best at the lowest cost.



PLUS A SPEEDY SHIPPING SERVICE

Bridge delivers by truck to your door within a radius of 200 miles from the plant. Fast freight will bring you Bridge reels in 5 days or less east of the Mississippi.

BRIDGE
MANUFACTURING CO.
HAZARDVILLE, CONN.

Phone
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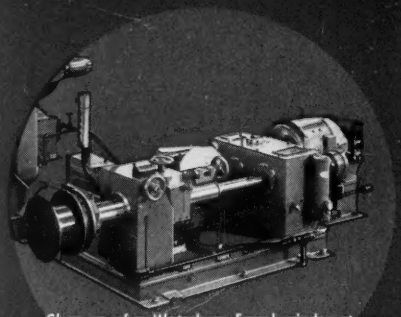
Riverview 9-8308

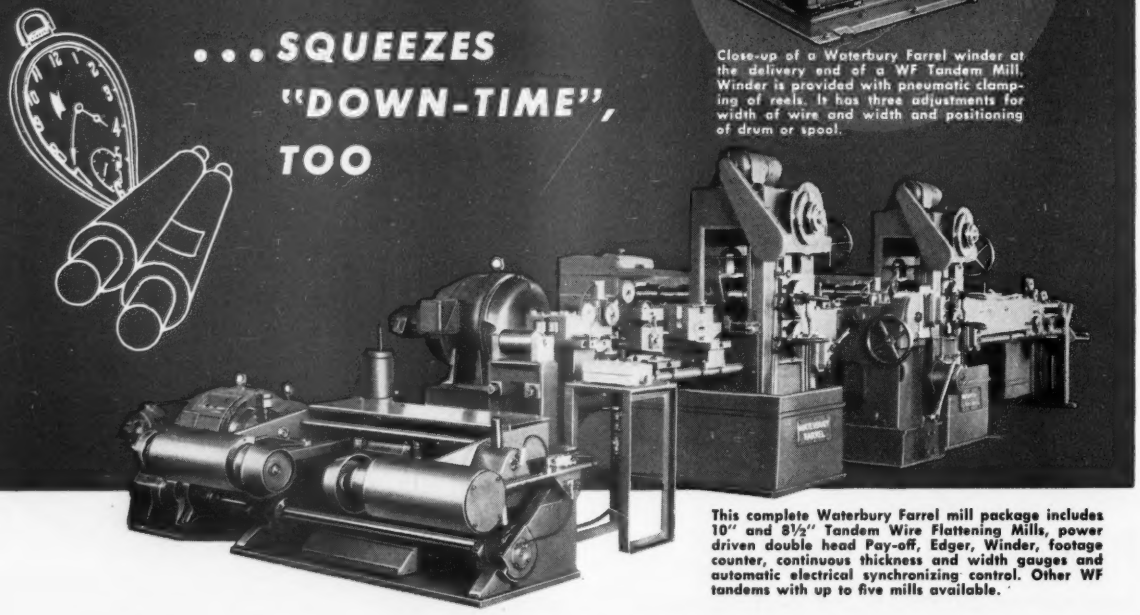
Let us quote on your reel needs. Send your specifications. Better yet, visit our plant and see how and why our reels are made so well at so low a cost.

THIS WF WIRE FLATTENING TEAM

. . . SQUEEZES "DOWN-TIME", TOO



Close-up of a Waterbury Farrel winder at the delivery end of a WF Tandem Mill. Winder is provided with pneumatic clamping of reels. It has three adjustments for width of wire and width and positioning of drum or spool.



This complete Waterbury Farrel mill package includes 10" and 8½" Tandem Wire Flattening Mills, power driven double head Pay-off, Edger, Winder, footage counter, continuous thickness and width gauges and automatic electrical synchronizing control. Other WF tandems with up to five mills available.

Modern Waterbury Farrel Mill Design Insures High Production Plus Precision . . . Minimizes "Down-Time"

Here are some reasons why Waterbury Farrel Wire Flattening equipment can give you *more continuous,* high speed, precision production.

- Loading payoff and motor driven screwdowns for mills and edgers facilitate threading of wire with minimum effort and time.
- To protect precision operation, soluble oil is circulated internally and externally on the rolls and into coolant enclosures where wire is submerged. A refrigeration system maintains the coolant oil temperature at approximately 70° while a flotation unit keeps it clean and fresh. In addition, high speed mills also have a self-contained, automatically-filtered circulating mineral oil lubrication system for roll necks and drives.
- Transparent lucite covers at vital lubrication points such as gear cases and universal joints make it easy to check lubrication at a glance.
- Anti-friction bearings are used for all rotating members including the winder shaft. High precision anti-friction bearings are used on roll necks and edger arbors. This, combined with precision fitting of component parts enables WF mills to maintain tolerances well inside commercial allowance.
- Tungsten carbide ring rolls permit rolling the toughest alloys and increase roll life.
- Electric control keeps wire tension constant. Dancer rolls are used for fine wire.

Waterbury Farrel designs and builds a wide range of wire flattening mill equipment to suit specific requirements. Various sizes and combinations of single and multiple mill stands with auxiliary equipment are available for flattening ferrous and non-ferrous wire from the smallest diameters to 1" diameter and more. Speeds range up to and above 2500 FPM.

Write for further information.

WATERBURY FARREL FOUNDRY & MACHINE CO.
WATERBURY 20, CONN.
***Sales Offices:* Chicago, Cleveland, Millburn, N. J.**

WATERBURY FARREL FOUNDED 1851

A FEW OF THE MANY TYPES OF METAL WORKING MACHINERY MADE BY WATERBURY FARREL

MILL MACHINERY—Rolling Mills: Strip, Rod, Wire Flattening, (For Ferrous and Non Ferrous Metals) • Also Slitters • Straighteners • Cut-off Saws • Coilers • Winders, etc. *WIRE MILL EQUIPMENT*—Continuous Wire Drawing Machines (Upright Cone and Tandem) • Wire Flattening Mills • Chain Draw Benches • Pointers Swagers • Bull Blocks • String-up Machines • Spoolers, etc. *COLD PROCESS BOLT & NUT MACHINERY*—Headers (all types) • Rivet Machinery • Trimmers • Thread Rolling Machines • Slotters • Nut Formers and Tappers, etc. *POWER PRESSES*—Crank, Cam and Toggle; also Rack and Pinion Presses • Eyelet Machines Multiple Plunger Presses • Horizontal and Hydraulic Presses, etc.

WF 9

WIRE AND WIRE PRODUCTS*

Reg. U. S. Pat. Off.

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 28 OCTOBER, 1953 No. 10

Designated as Official Publication By The Wire Association

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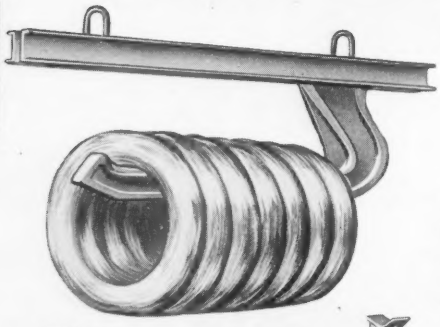
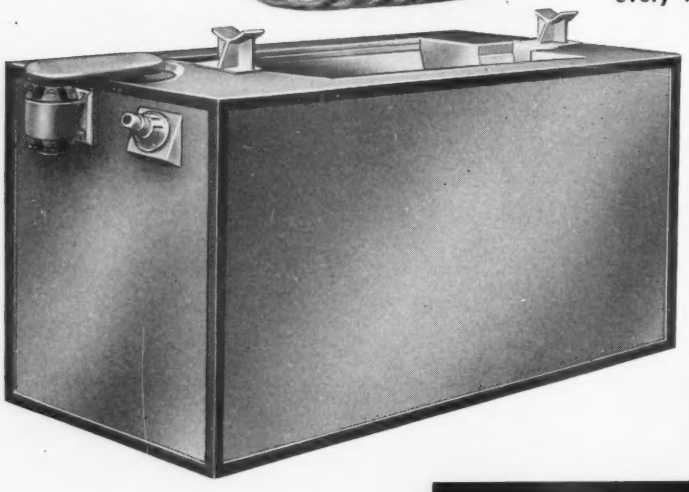
NEW—SIMPLIF ED—SMALLER

from the HEADQUARTERS for FLASH BAKERS!





In the nearly 20 years that our engineers have been building rod and wire bakers, they originated the Forced Convection Truck Type—the Flash Baker—and every major improvement in Baker Design.

NEW FEATURES OF THIS MODEL—

SMALLER SIZE—requires only shallow pit no larger than baker proper; FASTER BAKING—promoted by a new system of air distribution and reduction of waste space in Baking chamber; EASIER MAINTENANCE—because all working parts are above floor level; GAS OR OIL FIRED—combination burner permits switching from one fuel to other instantly; SHIPPED COMPLETELY ASSEMBLED—connect fuel lines and field wiring to complete installation.

ANOTHER JOHN R. MORRISON SPECIAL

NEW NAIL GALVANIZER

Built for medium production, this Nail Galvanizer has all features of larger units. Production varies from 600 to 1000 pounds per hour, depending upon requirements. The unit occupies a minimum of floor space—about 10′ x 10′.

The main cylinder is heated from a brick lined combustion chamber which may be either gas or oil fired.

Also Ideal for BLUING NAILS—GALVANIZING and BLUING SMALL PARTS . . .

By reversing the rotation of the cylinder, the nails or parts are discharged through baffles a few at a time into water. A mesh belt then delivers them to a gathering pan that is heated to assist in drying the nails. Drying and kegging operations take place while another batch of nails is being galvanized in the cylinder.

WRITE FOR COMPLETE INFORMATION ON BOTH OF THESE SPECIAL PROCESS MACHINES.

MORRISON INDUSTRIES

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CHASE WIRE can help keep your production costs down

You cut down rejects when you use Chase Brass and Copper Alloy Wire.

Chase mills inspect every coil of wire produced. No scratches, no slivers, spills, or laps! Chase wire is of uniform temper and grain size, uniform in surface texture and color, accurate in gauge. It comes to you clean and bright.

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Here's the World's BEST Insurance for Insulated Wire Manufacturers!

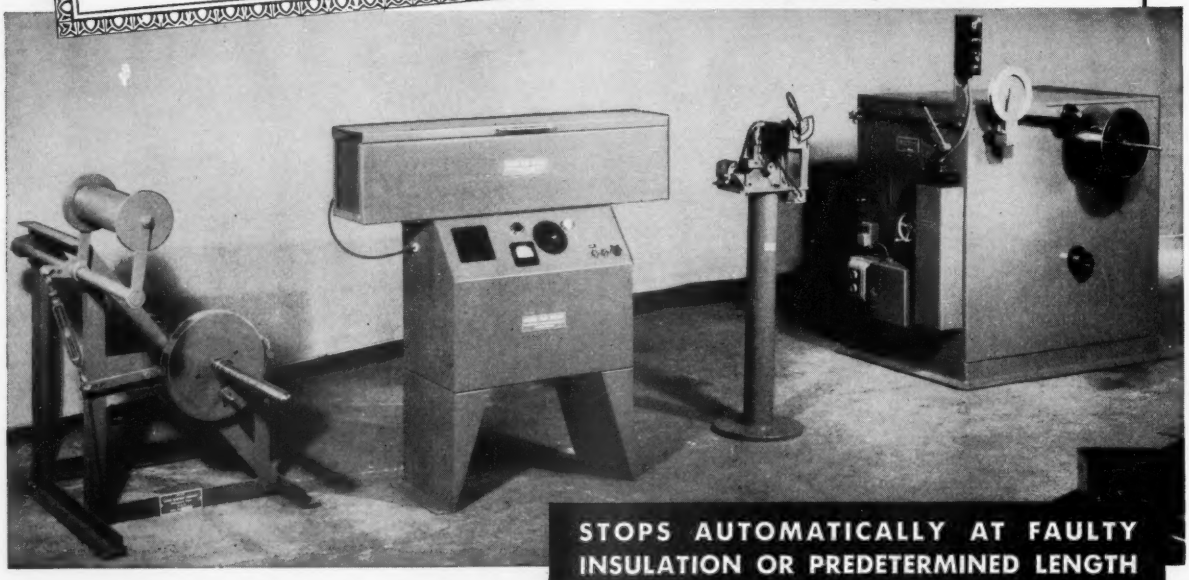
DAVIS

Automatic

SPARK-TESTING

Equipment

It insures against faulty wire insulation that causes customer problems.



STOPS AUTOMATICALLY AT FAULTY INSULATION OR PREDETERMINED LENGTH

DAVIS PAY-OFF (extreme left) automatically controls tension and braking, stops instantly when reeler or respooler shaft stops! Simply designed for left or right hand use . . . ruggedly built for lasting service. Shaft sizes: 1¼" or 1½"; for reels up to 30" diameter, 16" width.

DAVIS #4 SPARK-TESTER (left center) automatically stops at and locates insulation defects. It has a 36" stainless steel, bead chain electrode with maximum wire size of ¾" and wire speeds of 1200 fpm. Its volt-testing range is 1,000 to 15,000; up to 30,000 can also be supplied. Operates on 110 volts; other voltages obtainable. *Options:* footage can be increased by lengthening electrodes; electrodes available to accommodate up to 4" cable.

DAVIS WIRE MEASURING MACHINE (right center) with predetermined counter accurately measures wire footage. Counter is simple to set. At desired footage, its built-in switch shuts off power to reeler and respooler. Pedestal-mounted.

DAVIS REELER, RESPOOLER AND COILER is a versatile, variable speed unit with electrically or electronically controlled motor drive. Controls start machine with low torque to prevent wire stretching and/or breakage. Interchangeable shaft feature permits changing shafts in seconds. For reel diameters 6" to 30"; shaft diameters ⅝" to 1½". Constant footage device optional. Has electrical disk brake and safety cap for idler shaft. Easily accessible control synchronizes traverse variable speeds with spooling shaft speeds. Traverse width up to 16". Winding speed range: 10 to 1. Maximum wire speed: 1200 fpm. Unit adaptable for use with any type collapsible coiling head up to 30" diameter.

Accurate, dependable, easy-to-operate Davis products are available in complete assemblies as shown, or individually. Write for catalog bulletins and quotations on your requirements.

Davis ELECTRIC CO.

WALLINGFORD, CONN., U.S.A.

HARNESS TESTERS ★ PAY-OFFS ★ TRAVERSES

SPARK TESTERS ★ SPOOLERS ★ TAKE-UPS ★ CAPSTANS

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DAVIS WIRE & CABLE EQUIPMENT

MOSSBERG PRESSED STEEL CORP.

designed

NO-CREV SPOOLS

and **REELS** with

patented **DURA-CURL** rims

providing the ultimate
in strength and durability

P
L
U
S

precision and balance for
high-speed operation.

GREETINGS 1953

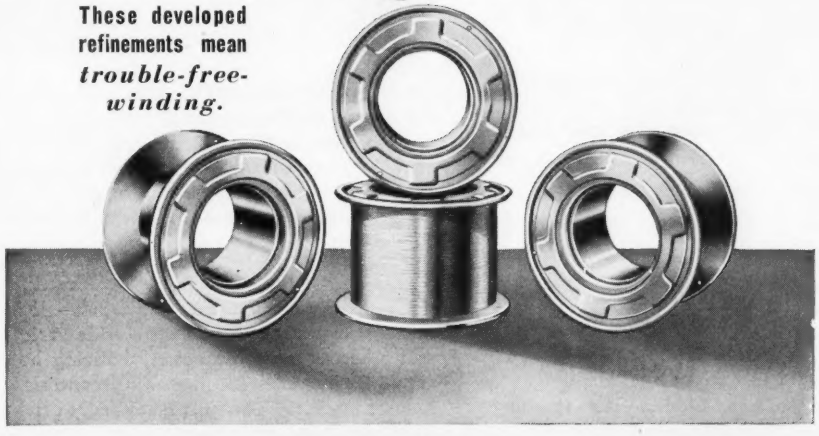
FROM THE LARGEST HEAVY DUTY

BREAK-DOWN-REELS

TO THE FINEST WIRE—

NO-CREV *DESIGN* **SPOOLS**

These developed
refinements mean
trouble-free-
winding.

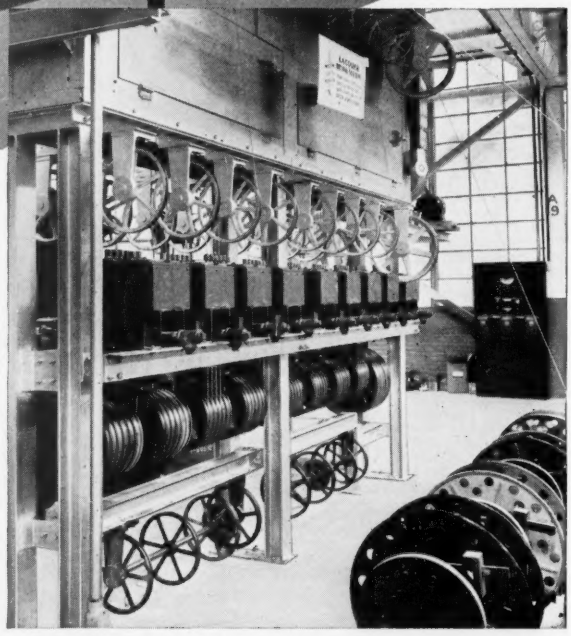


MOSSBERG PRESSED STEEL CORP.

18 WEST STREET — ATTLEBORO, MASSACHUSETTS, U.S.A. — Telephone Attleboro 1-0847 & 1-0848

James Day (Machinery), Ltd., 28 Maddox Street, London, W. I. England — #105

Whether you Coat with *Solutions* or Cover with *Asbestos*...



YOU'LL DO IT BETTER, FASTER, AT LOWER COST WITH AN IOI SYSTEM OF ADVANCED DESIGN

● Are you looking for ways and means of cutting production costs in your wire insulating operations? The largest wire mills in the world have found the answer to this problem by installing wire insulating systems and machines designed and built by IOI.

Whether your operations involve solution coating with lacquer, enamels, organosols or plastisols, or covering with asbestos, there's an IOI unit of advanced design that will increase your production, cut your labor requirements and decrease your production costs.

The lacquering unit and asbestos insulating machine pictured are typical of IOI's developments in advanced engineering on sound basic principles, efficient design and rugged construction.

Write for these helpful IOI booklets:

"Lacquering of Insulated Wire and Cable," "The Handling of Webs and Monofilaments."

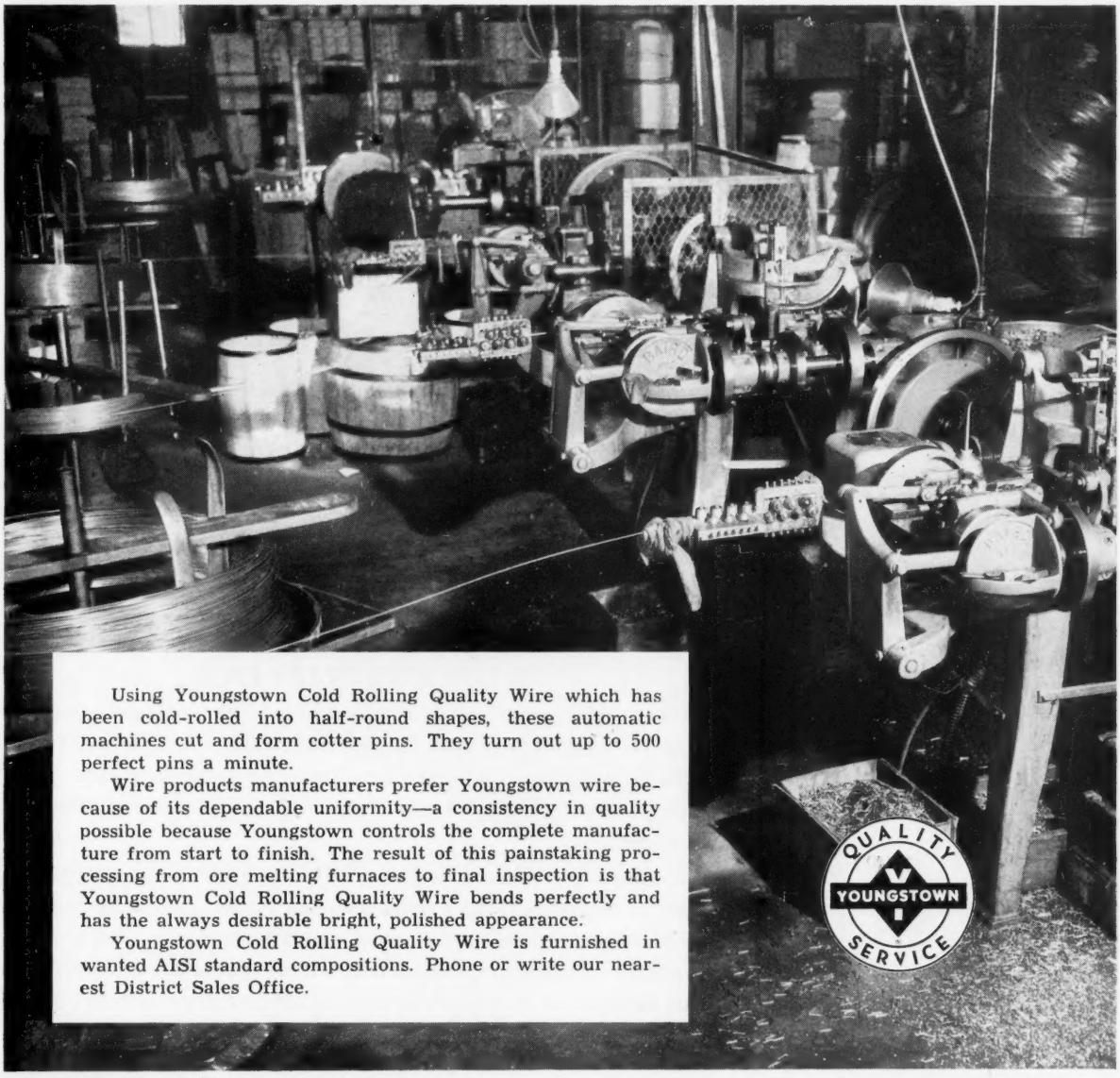
ORGANOSOL COATER—The organosol system shown above will handle 9 ends of wire, each end being coated with as many as 8 individual coats. It is the thirty-second such system installed by IOI. Photograph shows the general arrangement of the coating pots, the wire travel, the bottom idler sheaves and the base of the evaporating tower.

ASBESTOS INSULATING MACHINE—The IOI unit pictured at top left unwinds, wraps, cards, slicks, impregnates, cools, polishes, dries and winds—all in one continuous, fast operation. It handles a wide variety of wire sizes and asbestos wall thicknesses, utilizing hot or cold saturants. Easily accessible operating controls are located in base of machine. The unit is ruggedly constructed, easy to keep clean and maintain.

INDUSTRIAL IOI ENGINEERING VERSATILITY **OVENS, INC.**

13825 TRISKETT ROAD CLEVELAND 11, OHIO

500 PERFECT COTTER PINS A MINUTE WITH PERFECT-BENDING YOUNGSTOWN WIRE



Using Youngstown Cold Rolling Quality Wire which has been cold-rolled into half-round shapes, these automatic machines cut and form cotter pins. They turn out up to 500 perfect pins a minute.

Wire products manufacturers prefer Youngstown wire because of its dependable uniformity—a consistency in quality possible because Youngstown controls the complete manufacture from start to finish. The result of this painstaking processing from ore melting furnaces to final inspection is that Youngstown Cold Rolling Quality Wire bends perfectly and has the always desirable bright, polished appearance.

Youngstown Cold Rolling Quality Wire is furnished in wanted AISI standard compositions. Phone or write our nearest District Sales Office.

Youngstown COLD ROLLING QUALITY WIRE

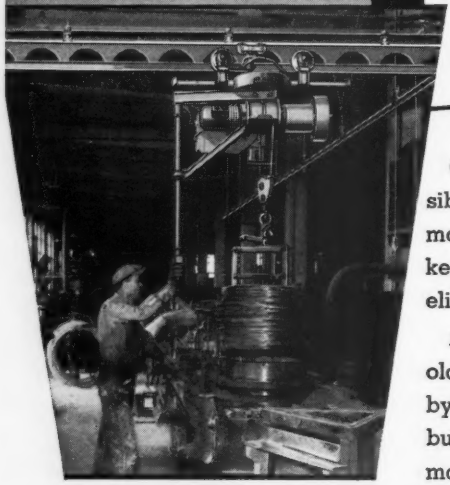
THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices: Youngstown, Ohio - Export Office: 500 Fifth Avenue, New York 36, N. Y.

PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS - COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RAILROAD TRACK SPIKES

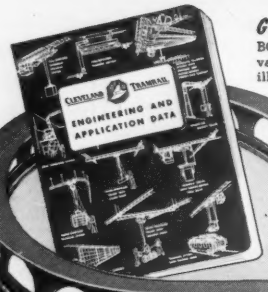
BLOCK STRIPPING CRANES and CARRIERS SPEED PRODUCTION

FOR INTERNAL OR EXTERNAL BLOCK STRIPPING



Cleveland Tramrail block stripping cranes and carriers make possible the drawing of heavier bundles and permit a man to take care of more blocks. With this equipment older experienced men can usually keep pace with younger men. Hernia injuries from heavy lifting are eliminated.

Available for internal stripping and also for external stripping of old-style non-slotted blocks, the cranes and carriers are easily propelled by hand by means of a rigid arm. At the lower end of the arm is a push button for convenient operation of the electric hoist. If desired, the hoist may be mounted on a turntable to serve blocks on two sides of an aisle.



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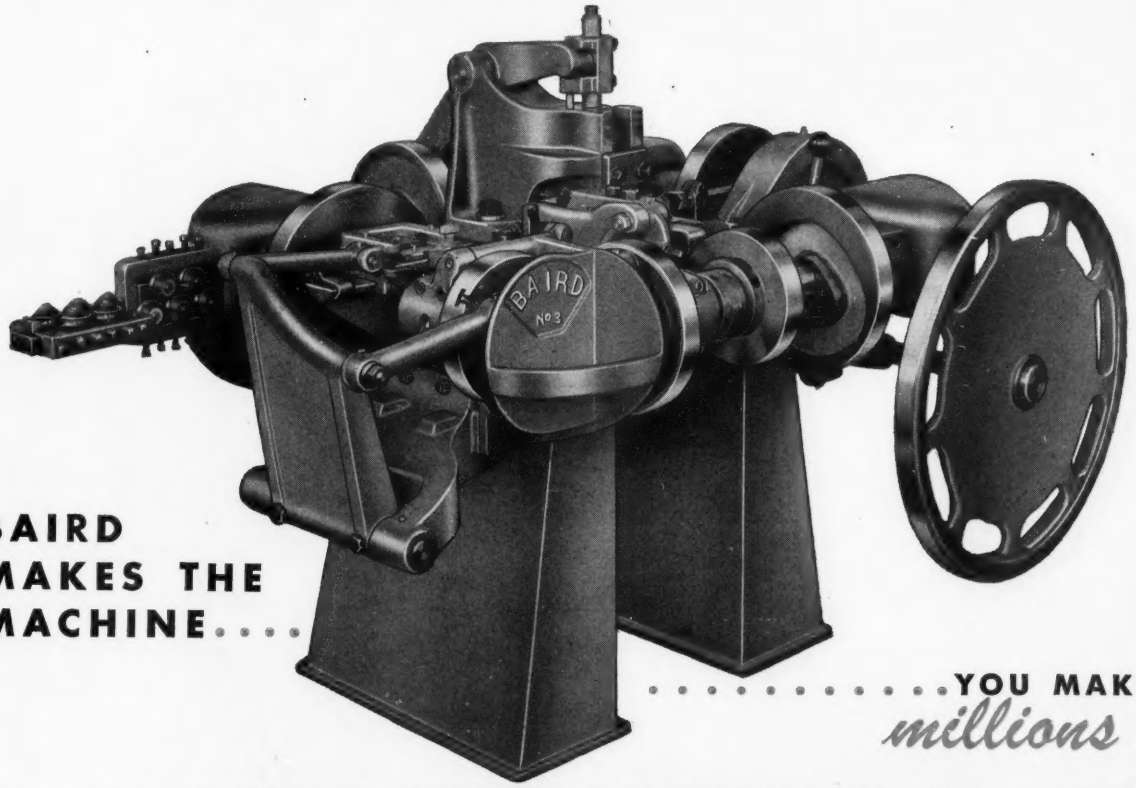
THE CLEVELAND CRANE & ENGINEERING CO.
9203 EAST 288 ST., WICKLIFFE, OHIO

CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT

ASK BAIRD ABOUT IT!

HIGH PRODUCTION TOOLING



BAIRD MAKES THE MACHINE. . . .

. . . . . YOU MAKE *millions*

. . . OF ACCURATELY FORMED WIRE AND RIBBON METAL PARTS

The Baird automatic Four-Slide Machine produces an extremely wide variety of articles made of any commercial wire . . . round, half-round, square, or flat . . . at highest speeds. It takes coiled wire from a reel, straightens, feeds, and cuts off the required length . . . then forms and ejects the part produced. Eight sizes handle shorter wire lengths; three sizes take longer lengths to 32½".

By means of special attachments, the versatility of the machine is further extended to include the making of round wire and ribbon metal rings, secondary cut-offs, lettering, and other operations.

The detailed and complete story, with specifications, is told in our new Four-Slide Bulletin. If you require hundreds of thousands or millions of wire units to ½" dia., or flat ribbon metal products to 1½" wide . . . this is your profit-making machine. Send for bulletin.

3BA53

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STRATFORD • CONNECTICUT

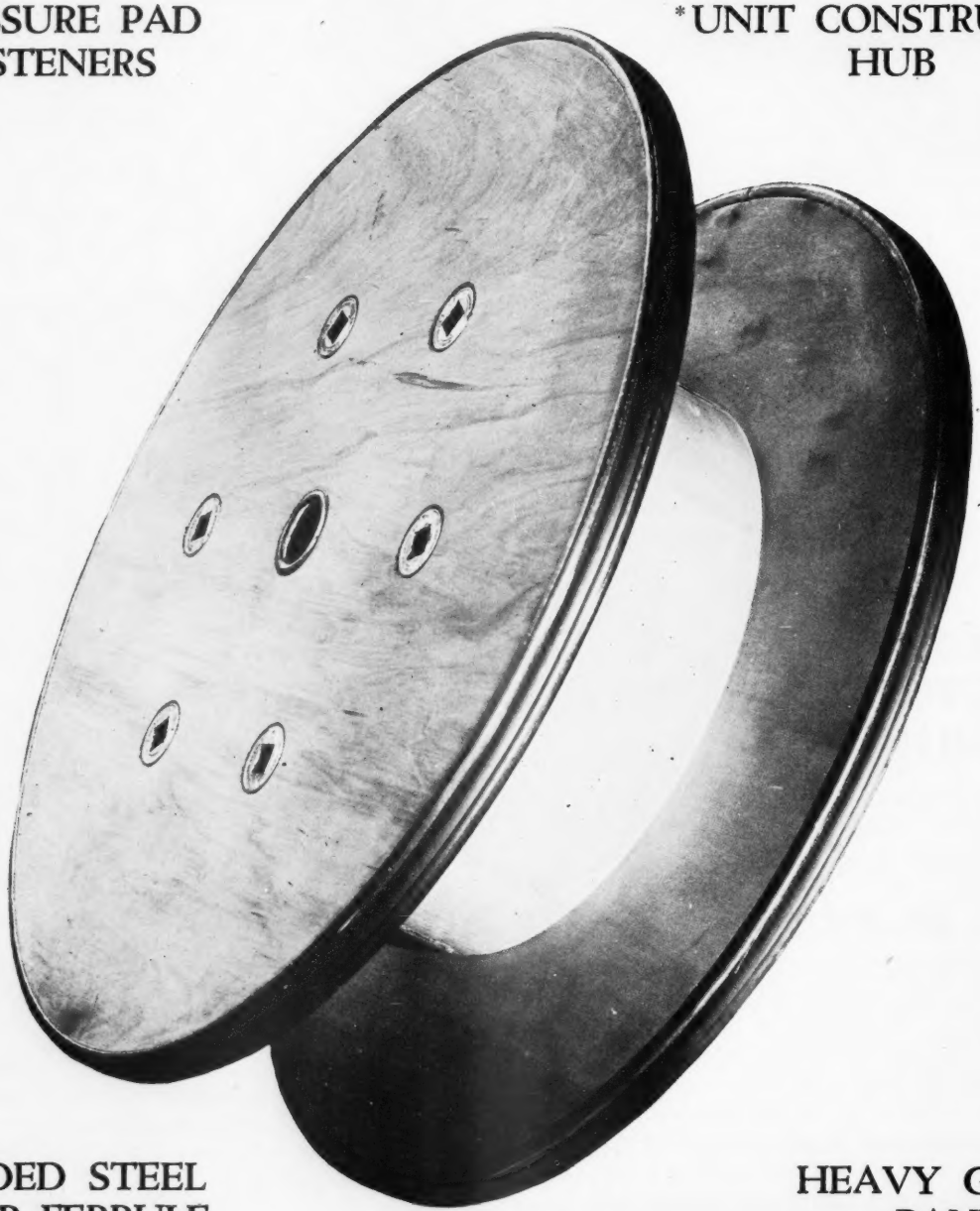
AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

SPOOLS and REELS

FOR SHIPPING

*PRESSURE PAD FASTENERS

*UNIT CONSTRUCTED HUB



WELDED STEEL ARBOR FERRULE

HEAVY GAUGE BAND

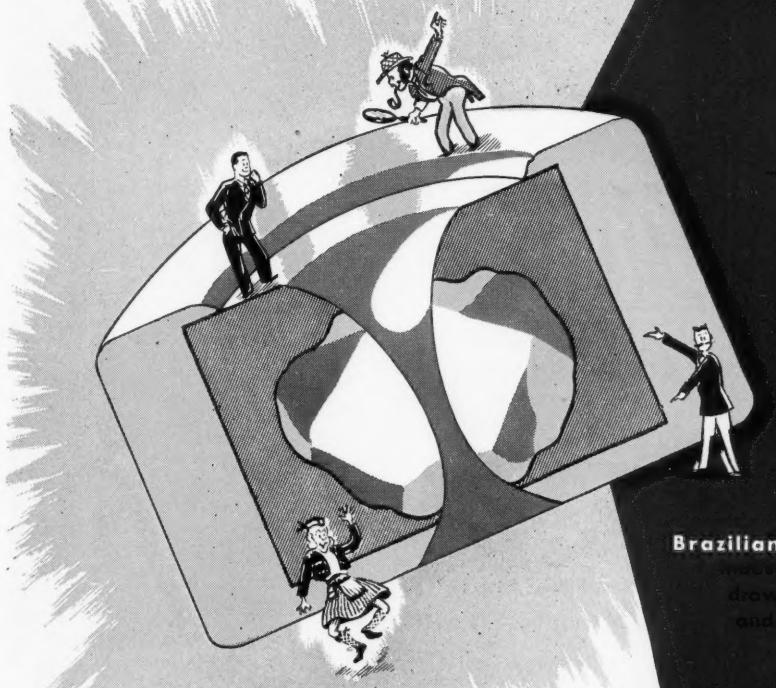
PHONE: 2-3043

HOWSAM SPOOL COMPANY

AURORA, ILLINOIS

* PATENTED

What To Look For In DIAMOND DRAWING DIES



The Trade-Mark "Roux"

—your assurance of diamond dies of utmost roundness, accuracy and long life — made with highest quality industrial diamonds, and specially selected by diamond experts for hardness, lasting quality and specific wire drawing needs. Roux selections are made from—

Brazilian diamonds— the hardest of all industrial stones that last longer in the drawing of steel, steel alloys, tungsten and other tough metals.

South African diamonds— second only to Brazilian in hardness, but extremely satisfactory for drawing copper, brass, aluminum and other highly ductile metals.

SIZE — SHAPE — HARDNESS

All three of paramount importance. Certainly size is important. However, equal consideration must be given to the shape and hardness of the stone; factors having a very important bearing on both the cost and the quality of the finished Diamond Die.

LOWER COSTS *"IN THE LONG RUN"*

It's false economy to try and save on initial die costs. True, quality diamond dies cost more in the beginning but their long life of usefulness will actually save you money. *Roux Diamond Wire Drawing Dies are a sound investment*

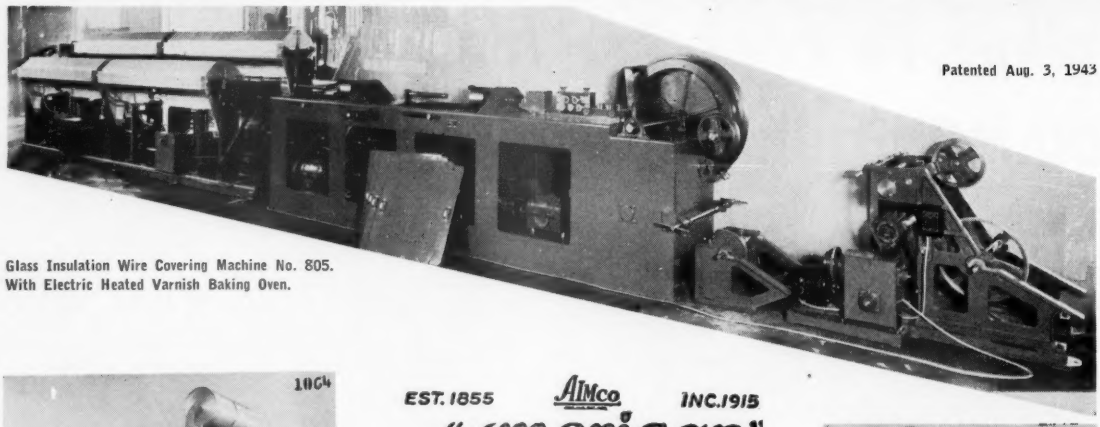
ROUX DIAMOND WIRE DRAWING DIES

If your present Diamond Dies are not giving maximum service, Roux can solve your problem; and there is no obligation for inquiring.

SERVICE FOR BEST RESULTS

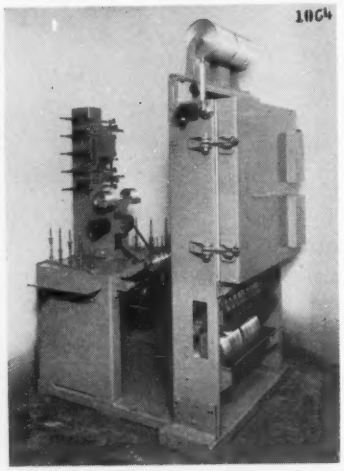
Our job is to meet your Diamond Die needs as well and as economically as is humanly possible.

Roux **WIRE DIE WORKS, INC.** ORISKANY, NEW YORK



Patented Aug. 3, 1943

Glass Insulation Wire Covering Machine No. 805.
With Electric Heated Varnish Baking Oven.



M-10 Enameling Machine No. 1064. Built especially to apply enamel to extra fine diameter wires.

EST. 1855 AIMco INC. 1915

"American" AIM INSULATING MACHINERY COMPANY

REG. U.S. PAT. OFF.

FAIRHILL AND HUNTINGDON STREETS

PHILADELPHIA 33 PENNSYLVANIA U.S.A.

WE SPECIALIZE IN
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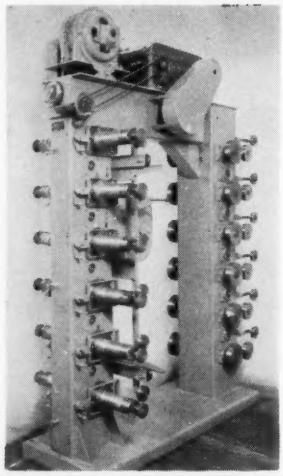
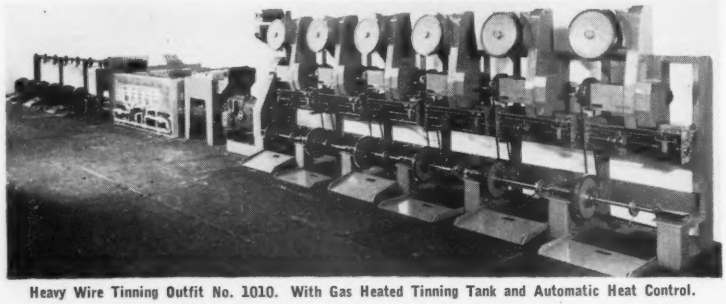
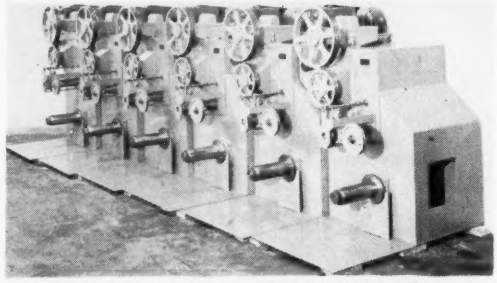
GLASS-COVERING, PANNING,
AND ALLIED MACHINERY.



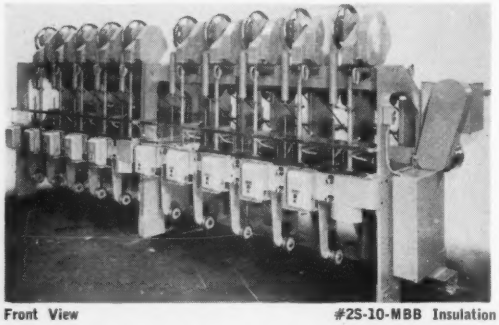
12 Unit Take-up Stand No. 1041. For use in wire tinning outfits, etc.



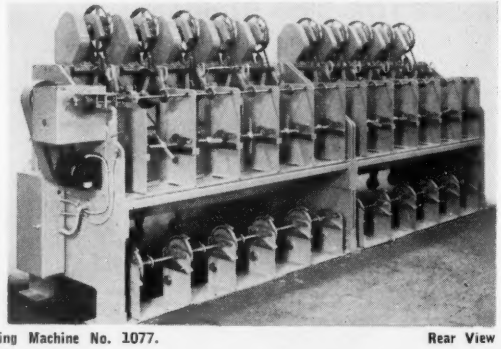
Heavy Wire Tinning Outfit No. 1010. With Gas Heated Tinning Tank and Automatic Heat Control.



Multiple Wire Take-up No. 1049. 6 individual units, each Reel-arbor torque motor driven. For use in wire tinning outfits, etc.



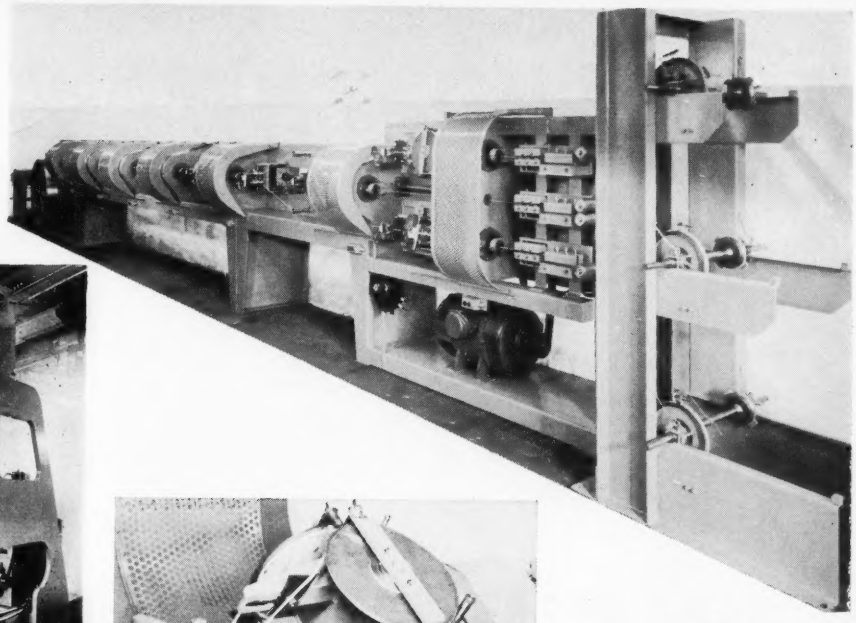
Front View

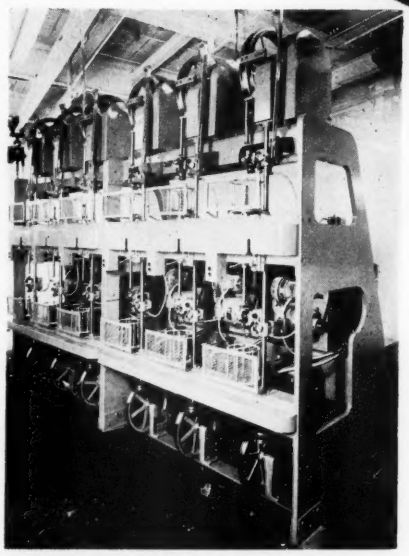


Rear View

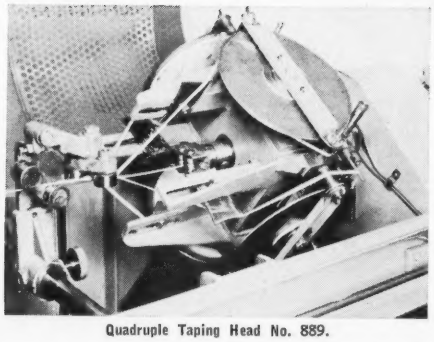
#2S-10-MBB Insulation Winding Machine No. 1077.
Applies a single cover to 10 lines of wire.

4 M-T-BB Taping Machine No. 1105. Arranged for individual wire double taping, then combining and multiple tape covering.





Double Taping Machine No. 1107. Applies 2 tapes to each of 6 round or flat wires.



Quadruple Taping Head No. 889.

EST. 1858 AIMco INC. 1918
"American" AIM INSULATING MACHINERY COMPANY
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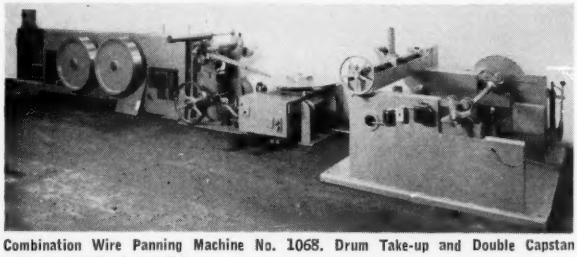
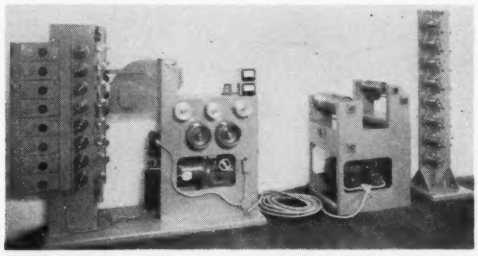
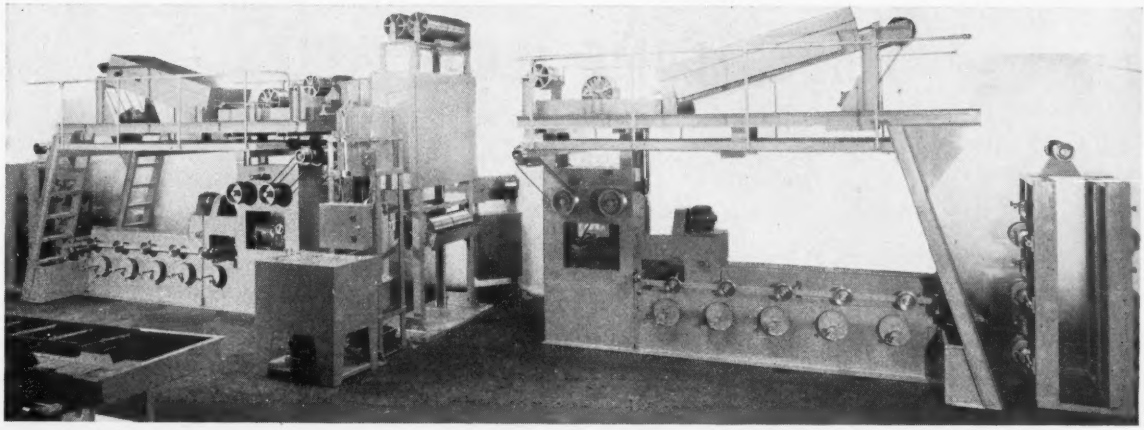
REFER TO NUMBERS



Combination Wire Panning Machine No. 1068. Drum Take-up and Double Capstan with Adjustable Speed Drive.



16 Unit Take-up with Let-off No. 1045. Let-off and Take-up capstan speeds are synchronized. Take-up spindles are Torque Motor driven.



Wire Enameling Machine outfit No. 997. With Pre-annealer, Storage, Circulating and Filter System for Enamel. Oven is higher than shown and is shortened to show top sheaves.

THE MONTGOMERY COMPANY

ESTABLISHED 1871

25 CANAL STREET

WINDSOR LOCKS, CONNECTICUT

BARE ELECTRICAL TINSEL CONDUCTORS

in long lengths, ready for insulating with textile rubber or plastic.

For Cords Used On

Telephones — Radios — Electric Shavers — Hearing Aids.

Used Bare for Voice Coil Lead Wires on Loud Speakers

Electric Shaver Tinsel meets U/L Standards

SILVER COATED COPPER WIRE

To ASTM Specifications for UHF Cables and Hook-up Wire to Industry and Government Specifications.

TINSEL LAME (FLAT WIRE)

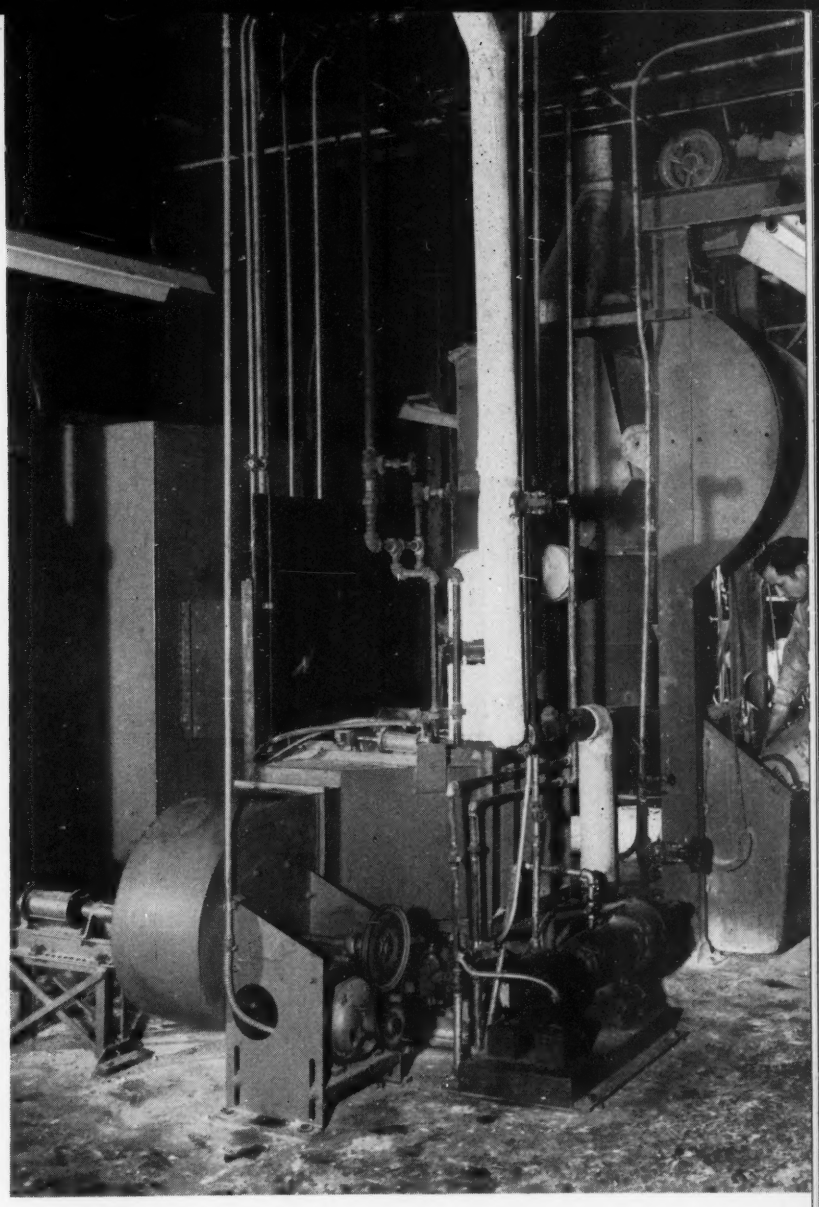
Silver and False Gold Coated Copper for weavers of tinsel ribbons and garlands.

"NEVA-TARN" GOLD & SILVER TARNISH PROOF YARNS

Plain, Supported or made into Novelty yarns. For knitters and weavers of dress, upholstery and drapery fabrics.

5 to 15¢ per lb. saved extrusion speeded 25%

WITH SPEEDMULLOR POWDER MIXES



FIVE TO FIFTEEN CENTS PER POUND saved with Special Speedmullor powder mixes as compared to the cost of Polyvinyl Chloride granules. The processing cost in the new Special Speedmullor is less than one-half cent per pound and yet mixing is so thorough that in recent comparative tests by several large processors only the Special Speedmullor proved acceptable.

The saving in cost is only part of the story. Important advantages are gained both in the mixing and the extrusion of Speedmullor powder mixes.

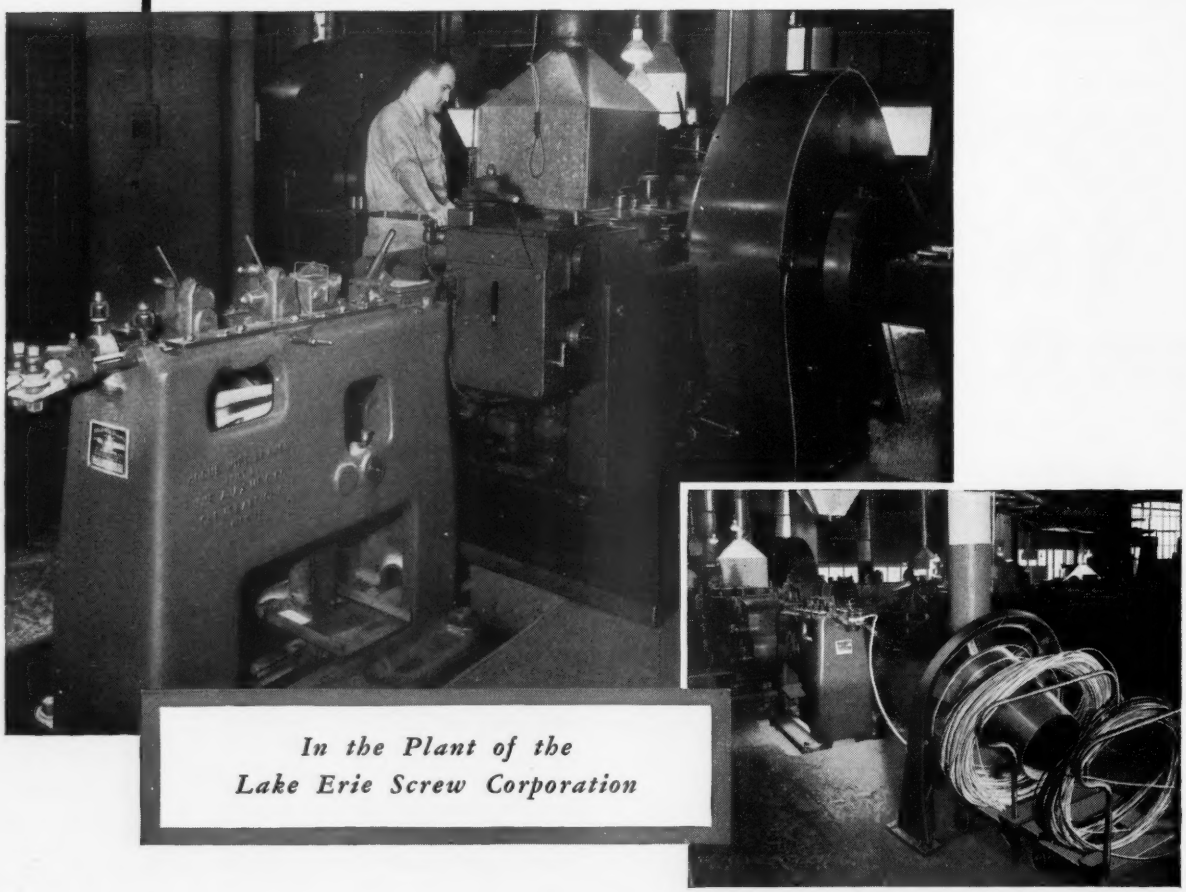
1. A 25% faster extrusion rate.
2. Colors are perfectly uniform and may be duplicated batch after batch.
3. Dielectric strength and other electrical properties are at least 10% higher than those obtained with PVC granules.
4. Products extruded from these powder mixes have greater elasticity and longer life.

An informative technical article describing the Special Speedmullor process of mixing Polyvinyl Chloride powders and the unique advantages of these powder mixes, is available without obligation. Write for your copy today.

BEARDSLEY & PIPER

DIV. PETTIBONE MULLIKEN CORP.
2424 N. Cicero Avenue
Chicago 39, Illinois

Wire Drawers Make Bolt Heading Easier



In the Plant of the Lake Erie Screw Corporation

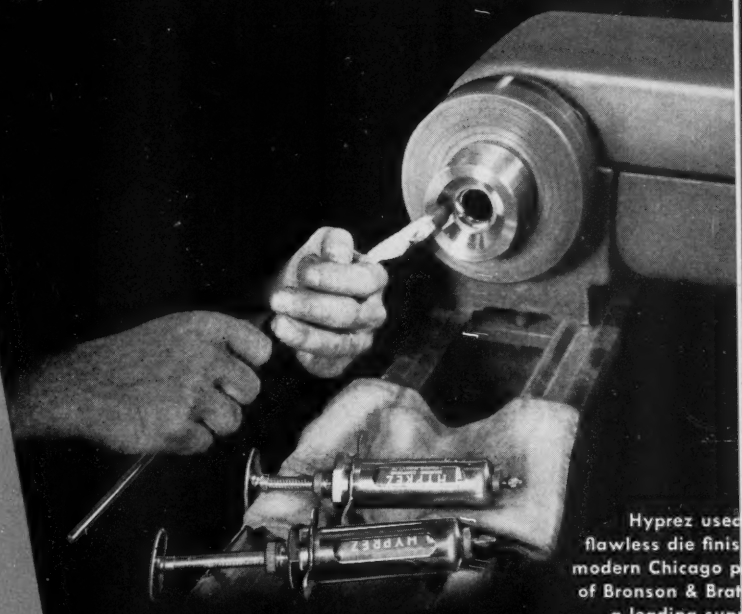
Ajax-Hogue Wire Drawers coupled with bolt headers improve the rate and quality of production while at the same time they effect other substantial savings.

The exactness of size, straightness and easier workability of clean, freshly drawn, freshly coated wire are factors which lessen the down time and greatly extend the life of the header die. These savings plus the additional saving in cost between hot rolled rod and more expensive mill drawn wire are achieved by many bolt manufacturers throughout the country by using Ajax-Hogue Drawers.

Write for Bulletin No. 111 for more complete information.

THE AJAX MANUFACTURING COMPANY
EUCLID BRANCH P. O. CLEVELAND 17, OHIO
110 S. DEARBORN ST. CHICAGO 3, ILLINOIS
DEWART BUILDING NEW LONDON, CONN.

finer dies faster for the wire industry with...



Hyprez used
flawless die finis
modern Chicago p
of Bronson & Brat
a leading sup
of tungsten-car
products for
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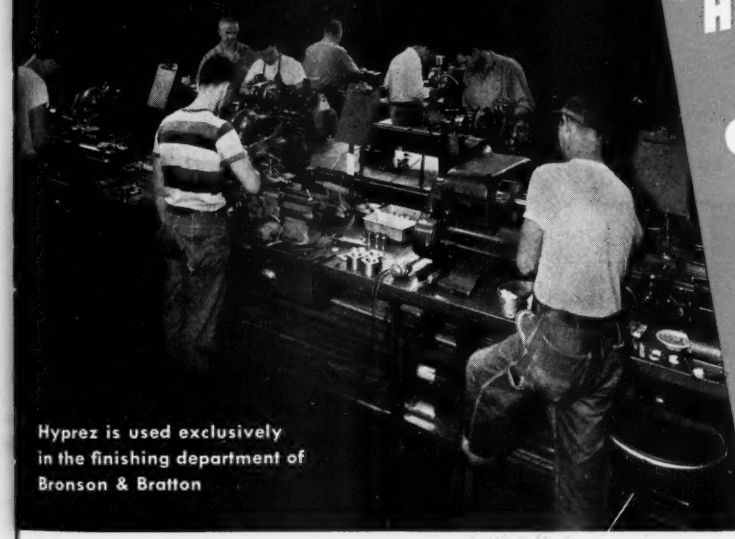
HYPREZ

High Precision DIAMOND COMPOUNDS

For economy of muscle, time and cost, Bronson & Bratton, Inc., Chicago, and scores of other die manufacturers and users, demand Hyprez, the original Diamond Compound.

Hyprez is engineered to highest standards of performance: diamond particles of exact grading and concentration; a vehicle assuring permanent suspension; integral color identification; maximum finishing action . . . A complete range of grades, from coarsest to finest.



Hyprez is used exclusively in the finishing department of Bronson & Bratton

Visit Hyprez Courtesy Headquarters,
Parlor A, Mezzanine Floor,
LaSalle Hotel, Wire Convention Chicago.

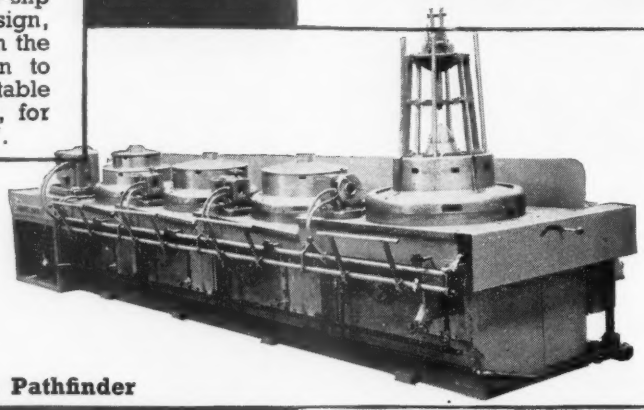
HYPREZ DIVISION

ENGIS EQUIPMENT COMPANY, CHICAGO 5, ILL.

431 SOUTH DEARBORN ST.

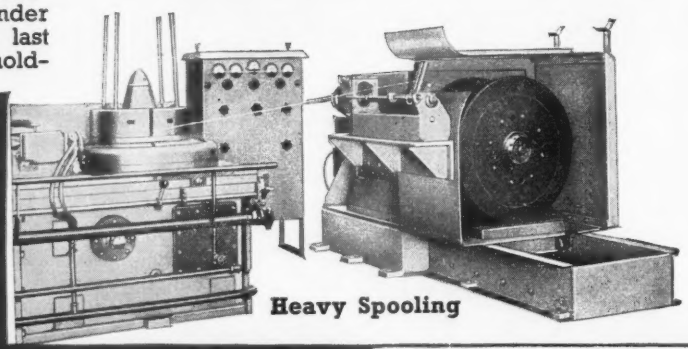
STEEL WIRE

A straight-through, non-slip machine of advanced design, drawing at high speed from the rod either in coils or on to heavy spools. Specially suitable for heavy inlets, finishing, for example, five holes to ·200".



The Pathfinder

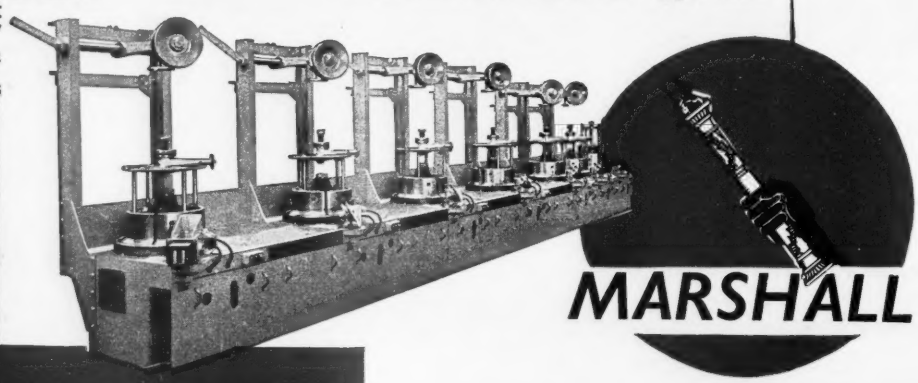
The practice, common in the copper wire industry, of finishing steel wire on spools, is a growing one. This photograph shows a Pathfinder delivering from the last block on to a spool holding two tons of wire.



Heavy Spooling

This and the following picture show two types of the useful and ubiquitous accumulation machine. The A.36 is the heavi est type we make. It takes blocks up to 30" diameter and motors up to 30 H.P. per block.

Accumulation Machine Type A.36

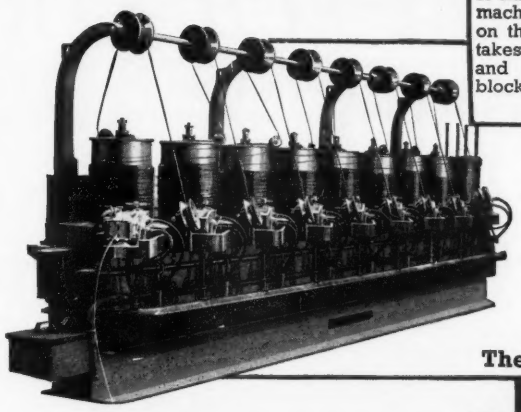


MARSHALL

DRAWING MACHINERY

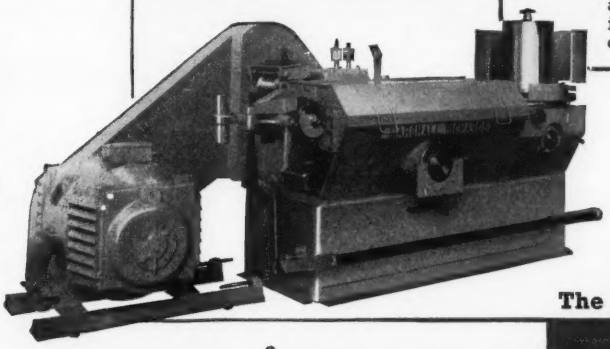
THE SIX MACHINES ILLUSTRATED ARE TAKEN FROM OUR COMPREHENSIVE RANGE OF MACHINES FOR DRAWING STEEL WIRE. ALL HAVE BEEN THOROUGHLY PRODUCTION TESTED AND THE EXPERIENCE GAINED IN USE HAS BEEN CAREFULLY EMBODIED INTO THE DESIGNS TO ENSURE HIGH PRODUCTION OF GOOD QUALITY WIRE FOR A LONG TIME.

MADE IN BRITAIN



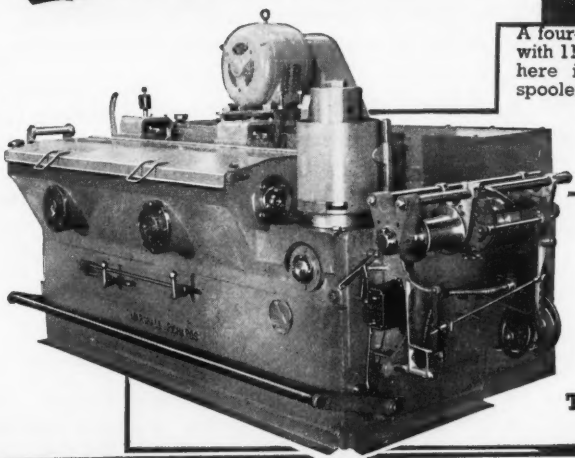
A smaller variety of accumulation machine than the type A.36 shown on the opposite page. This type takes blocks up to 12" diameter and motors up to 15 H.P. per block.

The Type A.20



A useful fine wire machine with 9 dies, drawing with the cones and dies fully submerged. Capable of a total overall reduction in area of about 83% and of taking inlets up to about ·080" diameter.

The 9.MS.2



A four-cone submerged machine with 11 or 13 dies. The one shown here is fitted with a magnetic spooler for 20 lb. spools. On this and the 9.MS.2. shown above, the dies reciprocate and powerful jets play under the liquor into the entrance of each die.

The F.S.4

RICHARDS MACHINE CO. Ltd.

CROOK • COUNTY DURHAM • ENGLAND

A Member of the Marshall Organization

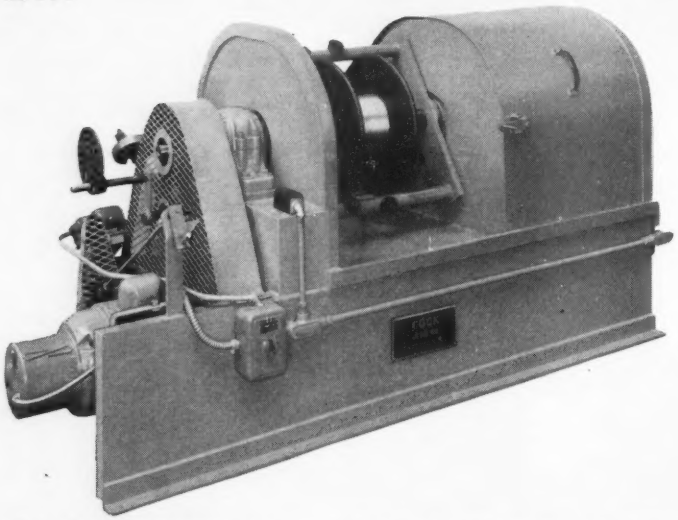
MR56

CONCENTRIC . . .
BUNCH STRANDING

DO YOU HAVE TROUBLE PRODUCING BUNCHED WIRE WITH THE SMOOTH CONCENTRIC QUALITIES OF STRANDED WIRE? IF SO THE COOK HIGH SPEED CONCENTRIC BUNCH STRANDER IS THE ANSWER TO YOUR PROBLEM.

HERE COMBINED IN A SINGLE MACHINE ARE THE ADVANTAGES OF BUNCHER AND STRANDER. THE COOK BUNCHER GIVES YOU SPEED AND CONCENTRICITY WITH NO SACRIFICE IN SPACE.

Shown below is the Cook Buncher Model B-H-21 which incorporates such worthwhile features as . . .



HIGH SPEED
(1400 twists per minute)

SINGLE TWIST FLYER

ELECTRONIC LAY CONTROL

LARGE TAKE-UP REEL
(350 pounds capacity)

This COOK BUNCHER has successfully formed bunched strands of 7, 10, 16, 19, 26, 41, and 65 wires with such concentricity as to enable its passage through an extruding die of only 1 mil clearance. In addition such constructions as 27/36 and 41/36 have been bunched at high speed with perfect concentricity on this versatile machine.

COOK MANUFACTURING COMPANY has a complete line of bunching equipment to accommodate the following reel sizes:

B-H-8	8" x 6"	Capacity	40 lbs.
B-H-12	12" x 8½"	"	100 "
B-H-21	21" x 8½"	"	350 "
B-H-22	22" x 11"	"	500 "
B-H-24	24" x 11"	"	700 "

Write today for descriptive literature giving details of construction and performance of this high speed concentric bunching machine.

OTHER COOK EQUIPMENT

• Wire Drawing Machines • Bunchers • Twisters • Wire String-Up Machines • Enameling Take-Ups and Pay-Offs
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• Wrapping Machines • Special Machinery

COOK MANUFACTURING COMPANY

50 EAST 25th STREET **PATERSON 2, N. J.**

Textilene Glascor® Fillers

(FIBERGLAS CENTERED)

OFFER GREATER TENSILE STRENGTH WITHOUT CHANGE IN BULK

Textilene® Glascor Fillers—for all types of wire and wire cables—are made with a Fiberglas center for greater tensile strength. They have better stripping action, greater flexibility, unusual uniformity—at lower cost. Another feature is high resistance to dry rot, mildew and fungus attack.

Talk to Twitchell people about your filler requirements. They'll be glad to give you technical assistance. No obligation.

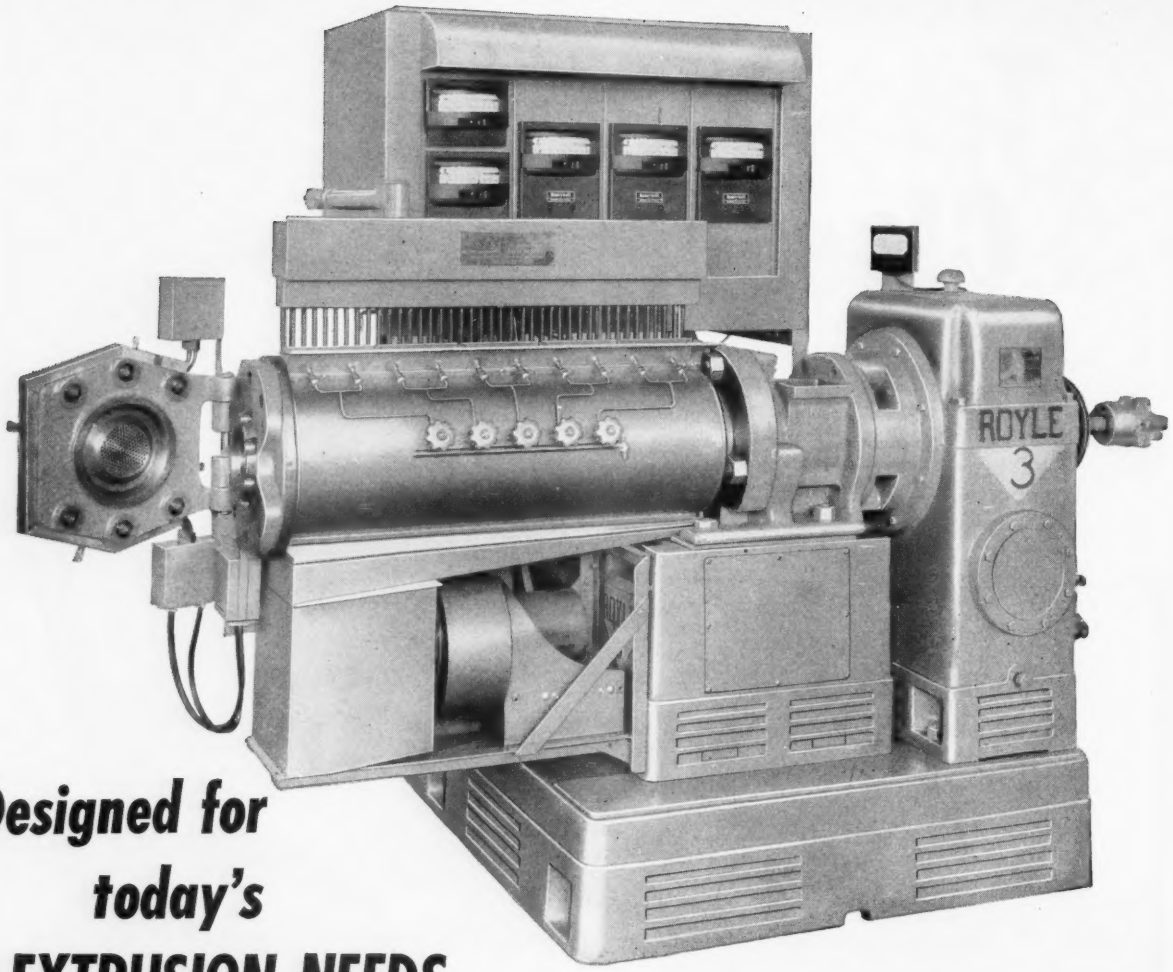
E. W. TWITCHELL INC.

Third and Somerset Streets

PHILADELPHIA 33, PA.

Paper Products for the Wire Industry

TWISTED · FOLDED · PRESSED · CRUSHED · SHAPED · BRAIDED · WOVEN



Designed for today's EXTRUSION NEEDS

ROYLE SPIROD* EXTRUDING MACHINES are designed to meet the needs of the plastics industry. Backed by nearly three-quarters of a century's experience in designing and building extruding machines, John Royle & Sons' engineers have incorporated time-tested features that insure dependable, low-cost operation.

The ROYLE SPIROD* shown (#3 – 4½" cylinder bore) is fully insulated and equipped for evaporative cooling. These features are available in all standard sizes.

*Patent Applied For

JOHN ROYLE & SONS

ROYLE PATERSON N. J. 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

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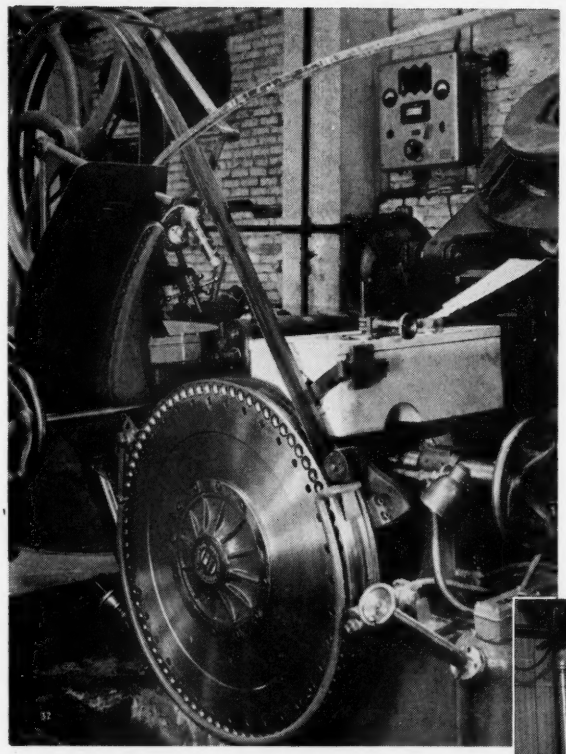
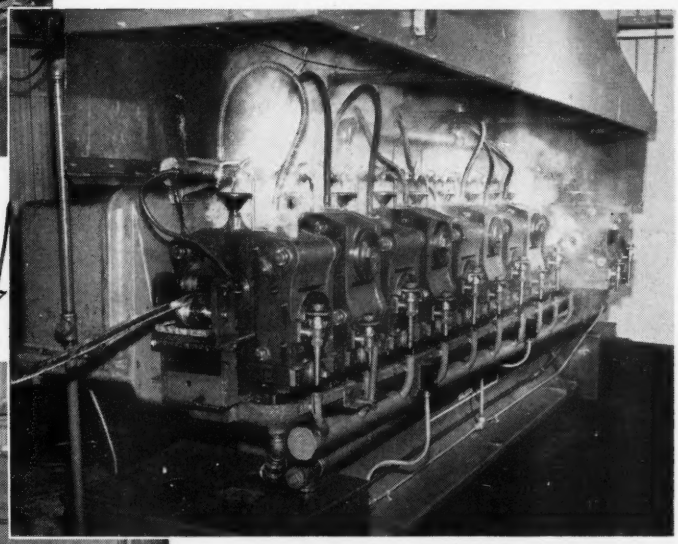
The PROPERZI PROCESS For the Continuous Casting and Rolling of ALUMINUM REDRAW ROD



Type 5A Casting Machine



Continuous Cast Rod (left above) entering rolling mill at Nichols' Davenport, Iowa plant

"REDRAW ROD" coils itself (left) in this view of rear of rolling mill

S.P.A. Continuous
Via Cosimo Del Fante 10
Milan, Italy
Ilario Properzi, Pres.

NICHOLS WIRE & ALUMINUM CO.
DAVENPORT, IOWA
Agents for Western Hemisphere, India, Japan and Australia

Users tell the quality story

Precision Spring Corp. Depends On Pittsburgh Steel Oil Tempered Spring Wire For Uniformity

Nothing, absolutely nothing, can raise Cain in a spring shop like wire that does not come up to analysis specified. Take complicated coiling machines like the automatic Torrington or Sleeper-Hartley, feed them steel wire at high speed that is a fraction off grade and wham! . . . you're in serious trouble. Mr. A. H. Peterson, president of Precision Spring Corporation, Detroit, Michigan, prominent spring maker for the auto industry, puts it this way: "Pittsburgh Steel's Wire has good uniformity. That's why we use it. We can depend on this wire to work well in production, ton after ton. Every spring we make must meet the customer's specifications for length, diameter, load, and deflection."

It all adds up to this: Lack of uniformity in steel wire within its specifications for grade can knock the profits out of spring making. One failure in fifty springs can turn it into a loss item. Spring failure in an automobile can put a spring maker out of business.

The men who make and sell Pittsburgh Oil Tempered Spring Wire would like to serve you. They would like to have you depend on them as one of your regular sources of supply.

Call our district office in your area, or write a note to Department WW, Grant Building, Pittsburgh 30, Pa., for complete information about Pittsburgh Steel Wire.

Pittsburgh Wire

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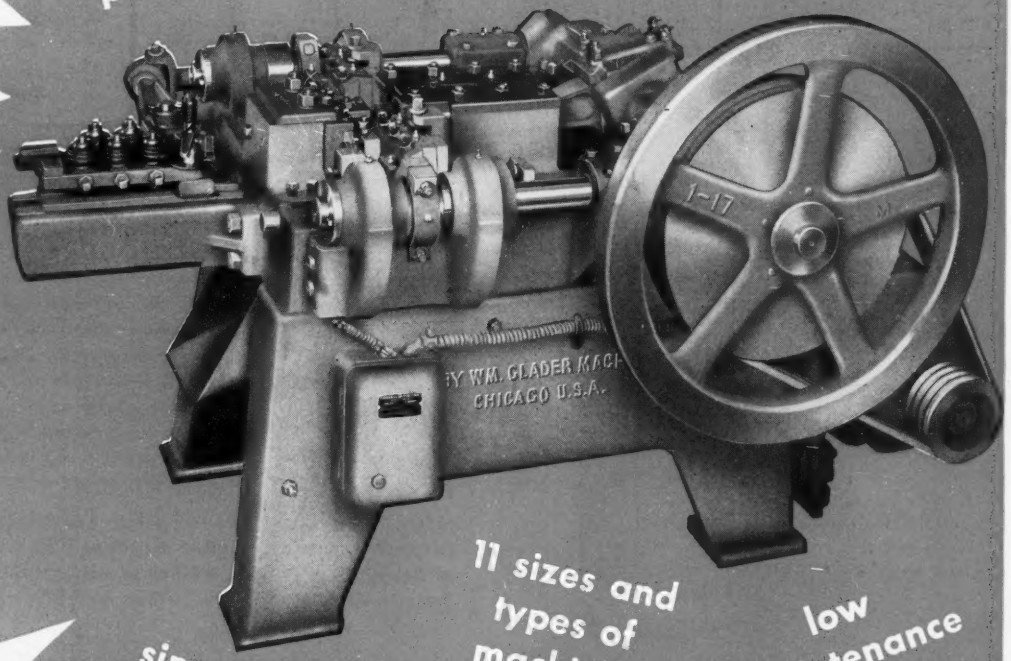
55 years of nail machine experience

world wide acceptance

proven performance

high efficiency



11 sizes and types of machines

low maintenance cost

simplicity of adjustments

rugged construction

WM. GLADER MACHINE WORKS

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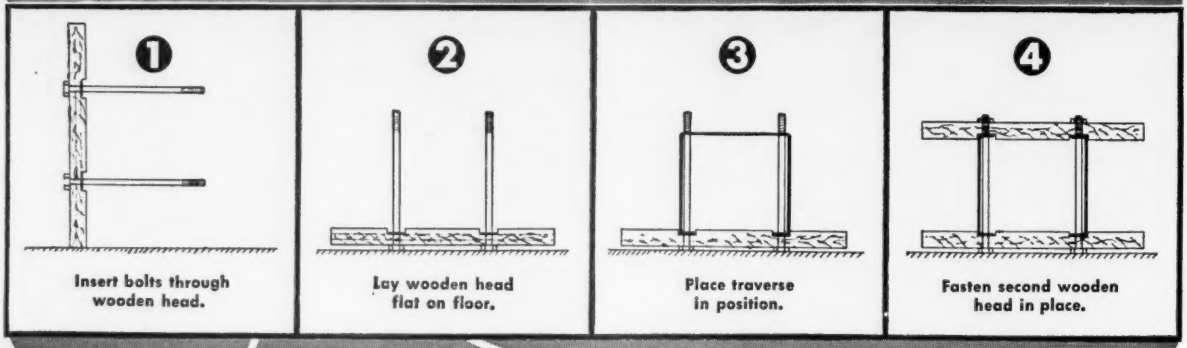
EXPORT DEPT. 122 EAST 42ND STREET • NEW YORK 17, N. Y.

Save Time • Labor • Space • Money through this simple 4-Step Assembly of NILES Flanged Steel Traverses



Niles Flanged Steel Traverses save time . . . because they require only four simple steps in reel assembly. They save labor . . . no special tools are necessary. They may be stacked and stored in a minimum amount of room . . . thus saving space. And they save money by providing long service life. Actual experience records show that Niles Flanged Steel Traverses have given as much as sixteen year's service–without refinishing or major maintenance. In many cases their use has doubled the number of trips per reel before cut downs or scrapping of wooden heads.

Niles "Reinforced Type" Steel Traverses have *extra strength* where it is needed most–at bolt holes and base of flange. Reinforcing makes possible the use of lighter gauge steel, saving up to 20% in weight while increasing overall length.

Sizes of Niles Flanged Steel Traverses range up to 56″ diameter and 48″ traverse. Finishes include plain, painted and hot dip galvanized. Width of flange and number of bolt and drain holes can be furnished to your specifications. Write today for prices.

PRESSED STEEL DIVISION
REPUBLIC STEEL CORPORATION
NILES, OHIO

REPUBLIC STEEL

NILES
FLANGED STEEL TRAVERSES

Sjogren WIRE MILL TOOLS

CRAFTSMANSHIP.....

Fine polished steel, a design which is excellent and executed by Sigmund Rockenberger, famed armorer of Wittenberg, Germany, are the elements which make up this unusual example of the craft skills in 1554. A delicate lacework pattern which ornaments not only this armet (or helmet) but all other parts of a complete suit of armor represent an early form of the chemical etching and baked enamel finishing processes so commonly known today.

The work of the Sjogren craftsman with his variety of hand-skills and inborn mechanical 'know-how' is best typified by the rugged strength and value-giving construction of the precision-made wedge grip. Sjogren wedge grips and wedge grip jaws assure each user of economical day-in and day-out use.

Used by Wire Men Who Want the Best!

Photograph of helmet made from an exhibit in the John Woodman Higgins Armory of Worcester, Massachusetts, and shown through their courtesy.

SJOGREN TOOL AND MACHINE CO., INC.

Tools for the Wire Industries

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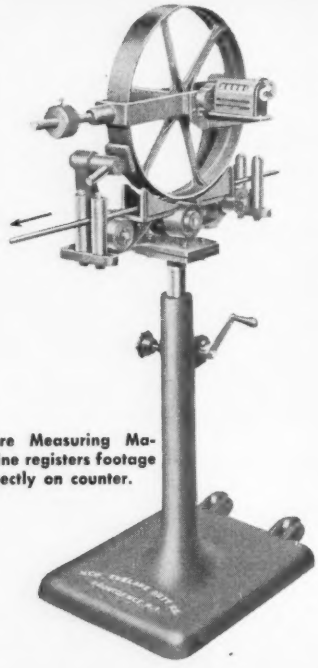
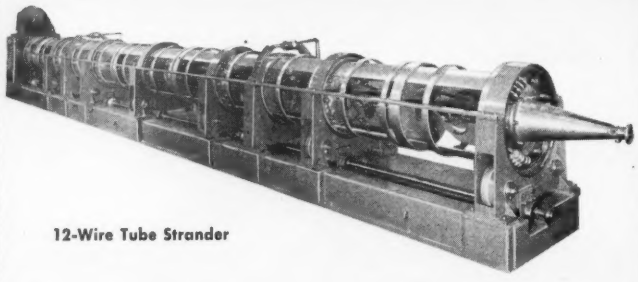
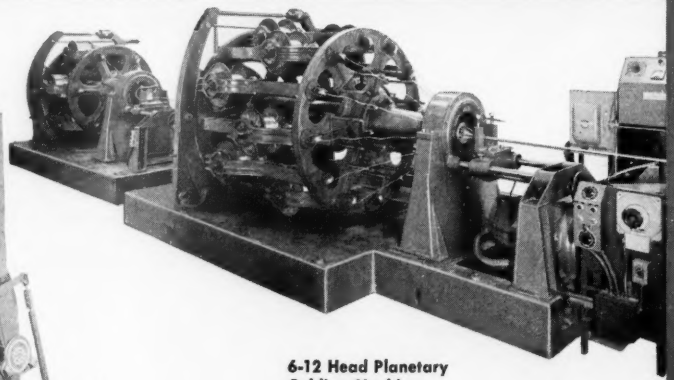
Engineered and built for dependable, high speed production, Nebuttco Equipment is the last word in wire making machinery. If you produce cables or strands, bare or insulated, we can help you improve your products and your profits. Ask for information and literature. New England Butt Company, 304 Pearl St., Providence 7, R. I. James Day (Machinery) Ltd., 28 Maddox St., London W1, England.



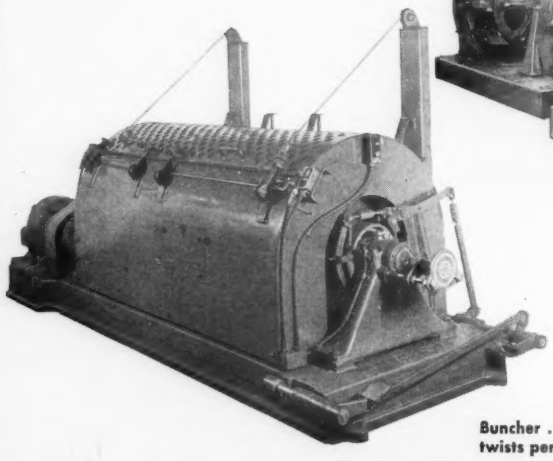
Wire Measuring Machine registers footage directly on counter.



12-Wire Tube Strander



6-12 Head Planetary Cabling Machine



Buncher . . . 1,000 R.P.M., 2,000 twists per min., 500 lb. spool

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MICRO PRODUCTS COMPANY

EXTENDS HEARTY GREETINGS TO ALL

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MICRO-WELD BUTT WELDERS ARE MANUFACTURED IN DIFFERENT MODELS TO BUTT WELD HIGH AND LOW CARBON STEEL AND STEEL ALLOYS IN SIZES FROM .004" TO 1¼" DIAMETER, AND NON-FERROUS WIRE AND RODS RANGING IN SIZE FROM .004" TO ⅞" DIAMETER

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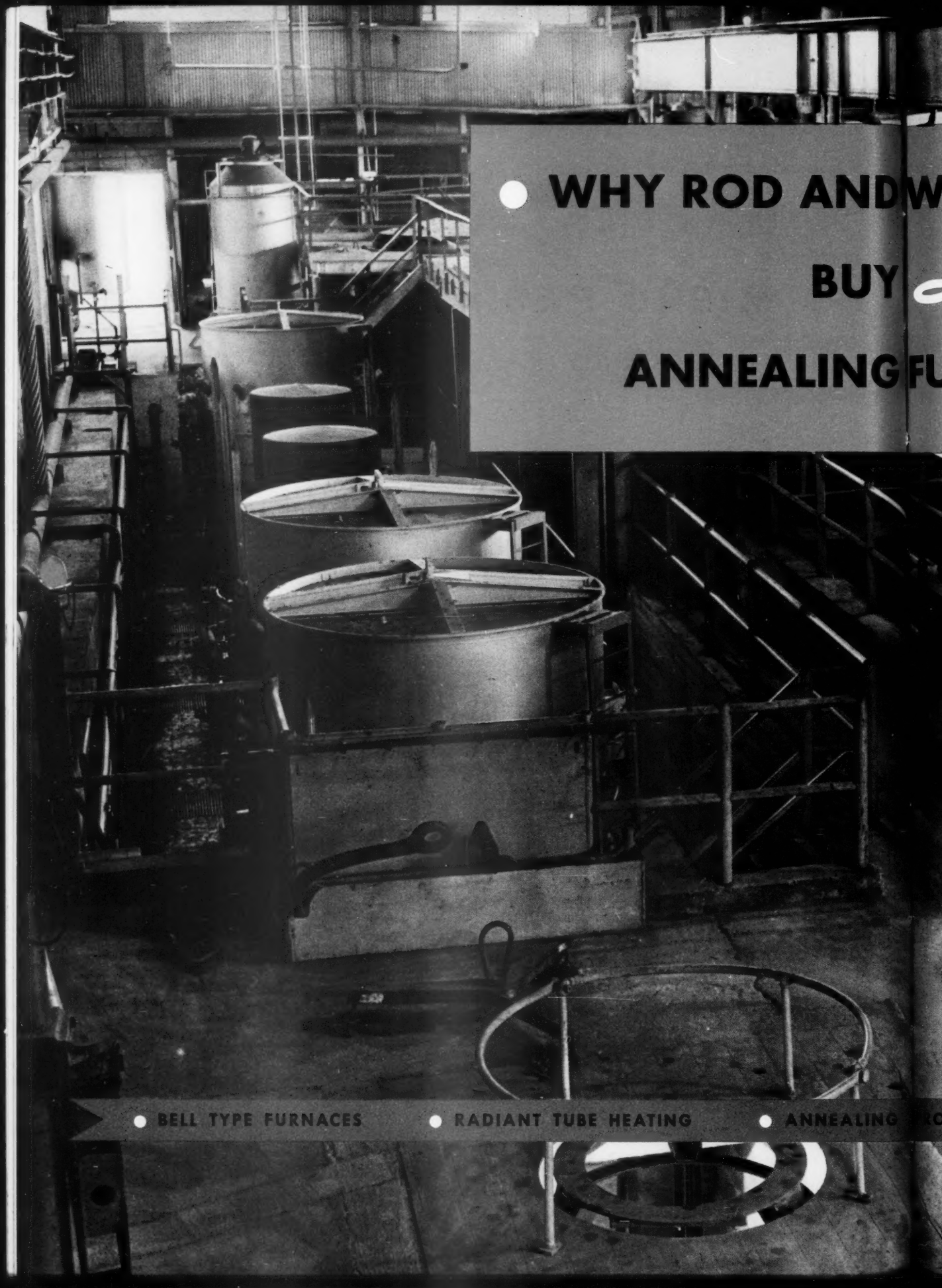
WHY ROD AND W
BUY
ANNEALING FU
BELL TYPE FURNACES
RADIANT TUBE HEATING
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Spheroidizing Steel Rod Requires the Extreme Accuracy of Lee Wilson Annealing Furnaces

Spheroidizing steel wire or rod is a touchy business. The steel must be brought carefully to just the right temperature throughout. When it reaches the proper temperature it must be held there for a period of time. There's no room for even the slightest variation.

And then, with the same care, it is slowly cooled, a degree at a time, until it is safely below critical temperature. After this it has a "spheroid" structure which obtains the carbide in a globular condition instead of the tool destroying "needle like" normal pearlitic structure.

This means that fabricators of products requiring high speed cold heading operations will be able to get greater production and a more finished and accurate product with minimum wear to expensive precision dies.

This extreme accuracy of annealing, required for spheroidizing, is the reason why more Lee Wilson radiant tube furnaces are used in wire and rod processing than any other type. The accurate control possible with the Wilson furnace produces perfect uniformity of structure so necessary for the low cost, high speed operations of automatic fastener making machinery.

If annealing of any description is part of your business, it will more than pay you to check with Lee Wilson, inventor and leading producer of radiant tube annealing systems.

Lee Wilson

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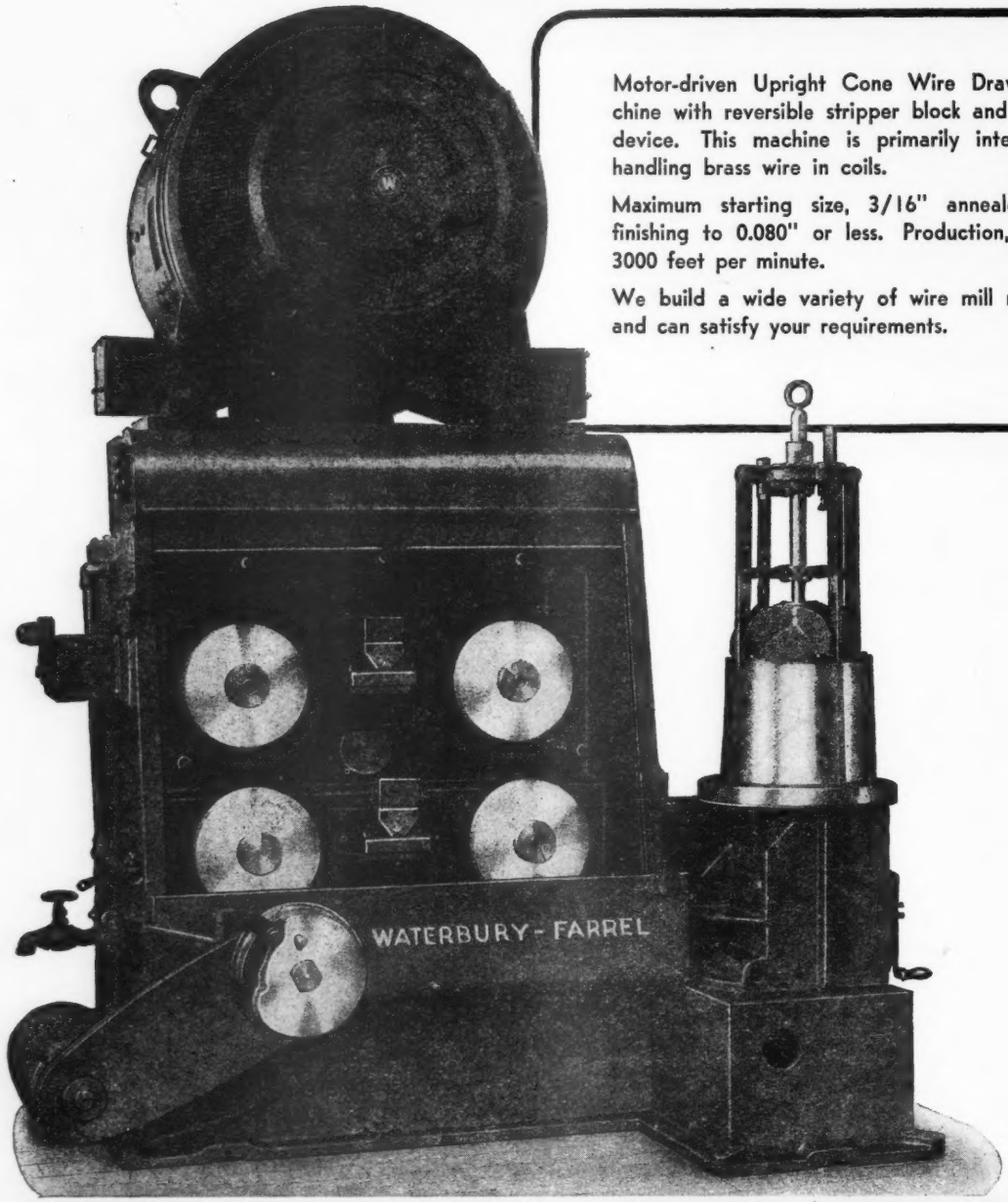
Rod coil spheroidizing department—
Youngstown Sheet & Tube Co., Youngstown, Ohio

Just one in a wide variety of . . . .

WIRE DRAWING MACHINES



Motor-driven Upright Cone Wire Drawing Machine with reversible stripper block and string-up device. This machine is primarily intended for handling brass wire in coils.

Maximum starting size, 3/16" annealed brass, finishing to 0.080" or less. Production, 1000 to 3000 feet per minute.

We build a wide variety of wire mill machinery and can satisfy your requirements.

WATERBURY FARREL FOUNDRY & MACHINE CO. • WATERBURY, CONN.

Offices: Chicago, Cleveland and Millburn, N. J.

WIRE MILL EQUIPMENT—Continuous Wire Drawing Machines (Upright Cone and Tandem) • Wire Flattening Mills • Chain Draw Benches • Pointers • Swagers • Bull Blocks • String-up Machines • Spoolers, etc. *COLD PROCESS BOLT & NUT MACHINERY*—Headers (all types) • Rivet Machinery • Trimmers • Thread Rolling Machines • Slotters • Nut Formers and Tappers, etc. *POWER PRESSES*—Crank, Cam and Toggle; also Rack and Pinion Presses • Eyelet Machines • Multiple Plunger Presses • Horizontal and Hydraulic Presses, etc. *MILL MACHINERY*—Rolling Mills: Strip, Rod, Wire Flattening, (For Ferrous and Non Ferrous Metals) • Also Slitters • Straighteners • Cut-off Saws • Coilers • Winders, etc.

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FINE WIRE . . .

FOR FINE PRODUCT DETAILS

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REG. U.S. PAT. OFF.

ROUND and SHAPED WIRE

. . . For Rugged Use and Product Sales Appeal

Our wire people spend much of their time solving problems for folks who use wire in their operations. Continental is geared to produce a great range of wire shapes and sizes. Whether yours is a product-trim problem . . . or a basic or component part need—Continental may have just the wire you want. And one thing is sure . . . you will like the service, interest and the production follow-through you'll get at Continental. Just write or phone us today at Kokomo. You'll be glad you talked with Continental.

*Trade Mark Reg. U. S. Pat. Off.

Standard and Special Wire Shapes

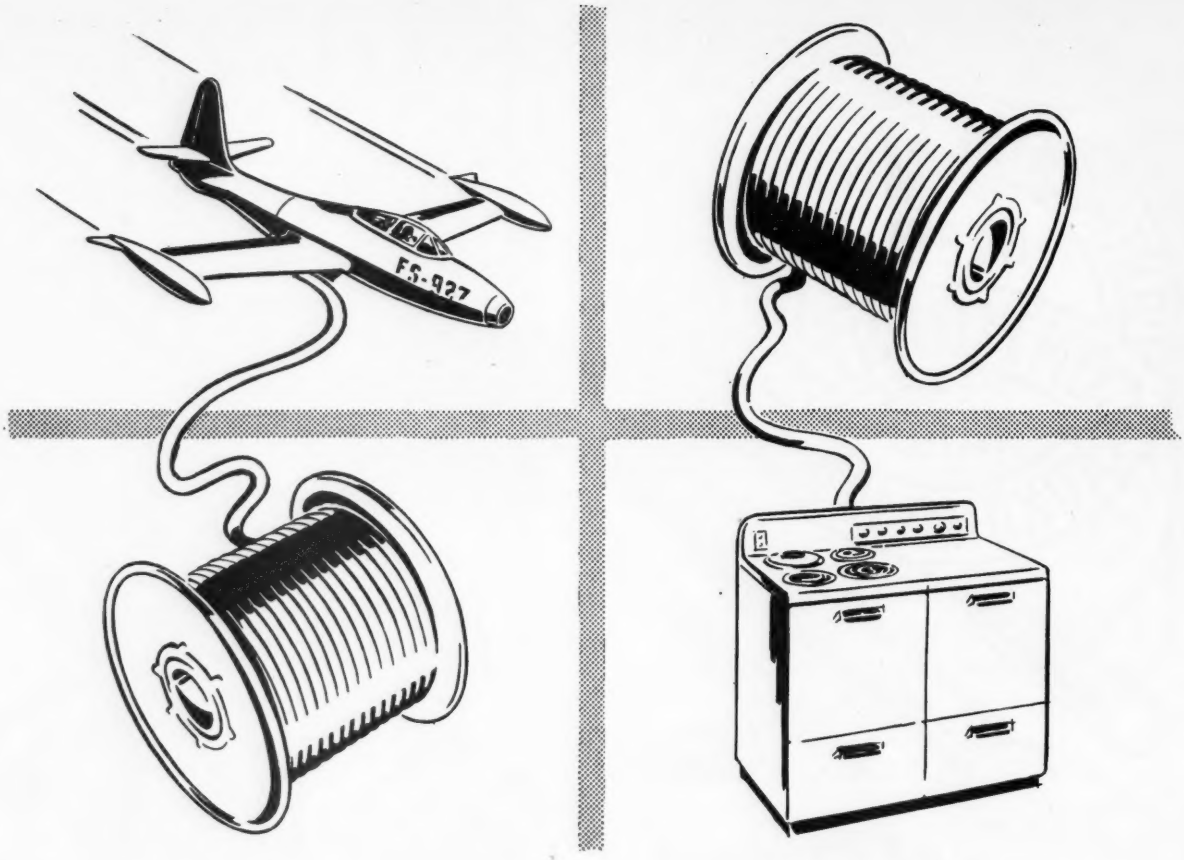
FLAT	KEYSTONE-SHAPED
HALF ROUND	STAR-SHAPED
ROUND	HEXAGONAL
OVAL	GROOVED FLAT WIRE
HALF OVAL	SPECIAL WIRE TRIM DESIGNS
SQUARE	
RECTANGULAR	BREAD-SHAPED
TRIANGULAR	D-SHAPED

CONTINENTAL STEEL

CONTINENTAL STEEL CORPORATION

GENERAL OFFICES • KOKOMO, INDIANA

PRODUCERS OF *Manufacturer's Wire* **in many sizes, shapes, tempers and finishes, including Galvanized, KOKOTE, Flame-Sealed, Coppered, Tinned, Annealed, Liquor Finished, Bright, Lead Coated, and special wire. ALSO, Coated and Uncoated Steel Sheets, Nails, Continental Chain Link Fence, and other products.**



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engineers wire insulation

to your exacting requirements

AT YOUR COMMAND.... the creative engineering of Standard's technical staff on your problems of wire insulation—from bombers to bottle-warmers! Credited to this group are many outstanding developments of the industry. Unsurpassed experience—for Standard has supplied insulating finishes to leading manufacturers for generations.

Your very special attention is invited to Standard's NON-TOXIC, flame-resistant impregnating compounds and solutions—as well as all advanced types of wire and cable lacquer coatings. Your inquiry is welcomed—consultation is without obligation.

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"STANDARD OF QUALITY FOR OVER A HUNDRED YEARS"

ELGIN'S "Layers of water"

PRODUCE A BETTER ABRASIVE

Water . . . an important ingredient for segregating the tiniest diamond particles in a unique Elgin process . . . a vital step in producing a precision abrasive! After pure diamond bort has been shattered and mechanically sieved into 10 grades, the finest sieve grade is placed in a large glass vessel of pure water, mixed into a slurry and allowed to settle. The heavier, larger particles sink faster . . . forming cloudy "layers" suspended in the water. At specified intervals, an Elgin-developed process removes these "layers of water", thus segregating the various weights of diamond powder while still in suspension. The result is absolute particle uniformity . . so necessary in producing a precision abrasive for precision finishes.

Every step of production, from crushing and grading to the finished DYMO product, is performed in Elgin laboratories under the strictest quality standards. Where only the finest, most reliable abrasives can be used . . . be sure to FINISH WITH DIAMOND . . . ELGIN DIAMOND!

Ask for a free demonstration!

ABRASIVES DIVISION

ELGIN NATIONAL WATCH COMPANY

ELGIN, ILLINOIS

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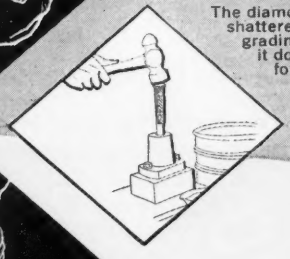
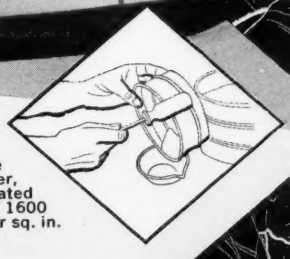
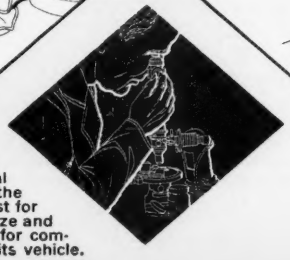
Here's how all Elgin Diamond begins . . . in an $8,000 handful of pure, virgin diamond bort, the finest quality obtainable for abrasive production.



The diamond bort is shattered at the start of the grading process . . . breaking it down into fine particles for further separation.



A special "shimmy" machine vibrates the diamond powder, separating it into 10 graduated sieves with meshes from 1600 to 105,625 openings per sq. in.

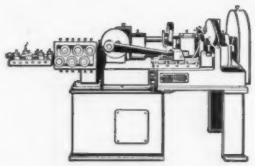


Following the "layers of water" process, a final inspection checks the graded diamond dust for correct particle size and grade . . . ready for compounding into its vehicle.

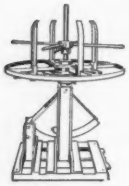
SHUSTER Since 1866

WIRE STRAIGHTENERS & CUT OFF MACHINES

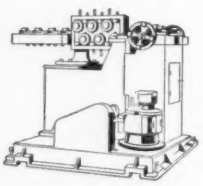
ACCURATE AUTOMATIC AND ECONOMICAL



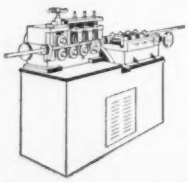
SLIDE FEED STRAIGHTENERS
3/8" x 10"; 9/16" x 10"



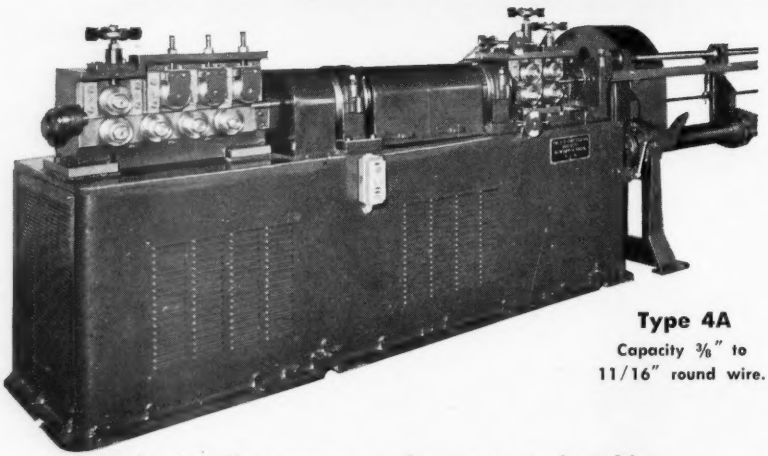
REELS
400 lbs.



FEED STARTER AND STRAIGHTENER
Max. 5/8" dia.



TUBE AND BAR STRAIGHTENER
7/32" to 5/8" bar 1" tubing



Type 4A
Capacity 3/8" to 11/16" round wire.

Round wire, flat, square or hexagon stock, tubing—all are straightened and cut faster, more accurately and more economically because of SHUSTER automatic features.

Each operation of the machine is perfectly integrated, delivering straight, exact lengths with square, clean-cut ends.

There is a SHUSTER for every wire straightening job from .025 to 11/16" diameter. Over 30 models to select from. Write today for our recommendation, describing your needs. No obligation whatever.

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Representatives in all principal cities and in foreign countries.
NEW YORK OFFICE: Eleven Broadway, Tel.: WHitehall 4-5480

Technical Data on Request

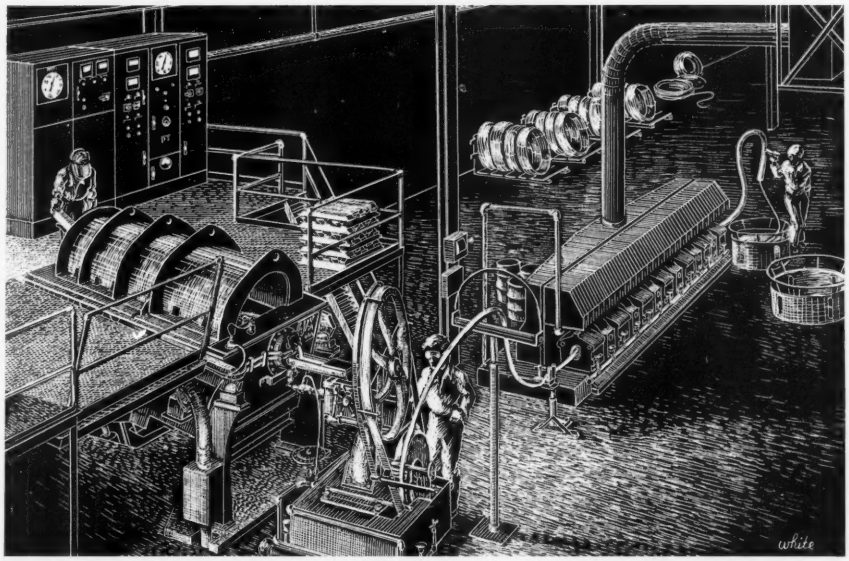
Mettler Machine Tool, Inc.
132 W. Lawrence St., New Haven, Conn.

Gentlemen: Please send us technical data.
We use wire from ..... " to ..... " dia. in lengths from ..... to .....
Name: .....
Company: .....
Address: .....

SHUSTER Automatic

Since 1866
WIRE STRAIGHTENING AND CUTTING MACHINES

From Molten Aluminum to 3/8" Diameter Rod in 1½ Minutes!



Rome Cable Corporation

uses AJAX INDUCTION FURNACES for

MELTING ALUMINUM FOR CONTINUOUS CASTING AND ROLLING OF HIGH CONDUCTIVITY ROD

The picture above, a drawing made at the Rome Cable Corporation, Rome, N. Y., shows one of the most modern installations in the country for the continuous casting and rolling of aluminum rod directly from molten metal. From left to right are shown the electric controls of the adjacent 450 kW. AJAX low frequency induction combined melting and holding furnace which is pouring molten metal into the Properzi continuous casting machine in the foreground, and the rolling mill from which the coiled rod is emerging.

This installation casts at the rate of about one ton per hour. The furnace feeds a continuous stream of molten aluminum at automatically controlled temperature into a rim cavity on the slowly revolving wheel of the Properzi machine. Metal loss from pig to rod averages less than 1 pct. Mechanical properties and electrical conductivity are excellent; the material is sound and fine grained. The men work under cooler, cleaner conditions because the only heat generated is within the melt itself. Due to melting conditions inherent in AJAX furnaces, the operation is continuous and no fluxing is required.

VISIT THE AJAX BOOTH No. 221, AT THE METAL SHOW

AJAX

TAMA-WYATT

AJAX ENGINEERING CORP., TRENTON 7, N. J.

INDUCTION MELTING FURNACE

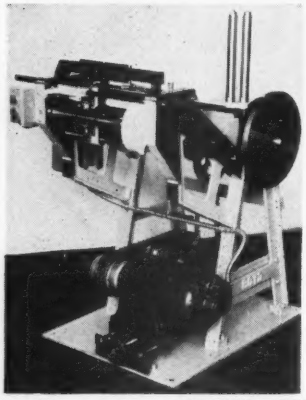
AJAX ELECTRO METALLURGICAL CORP., and Associated Companies
AJAX ELECTROTHERMIC CORP., Ajax-Northrup High Frequency Induction Furnaces
AJAX ELECTRIC CO., INC., The Ajax Hultgren Electric Salt Bath Furnace
AJAX ELECTRIC FURNACE CORP., Ajax Wyatt Induction Furnaces for Melting

FOR THE BEST IN SPOOLING, COILING AND WINDING EQUIPMENT

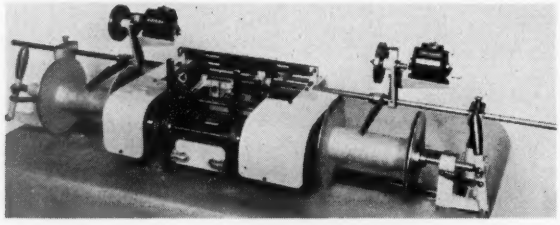
LOOK FOR THE "BOYD" NAMEPLATE –

Your Guarantee of Machine Quality and Performance

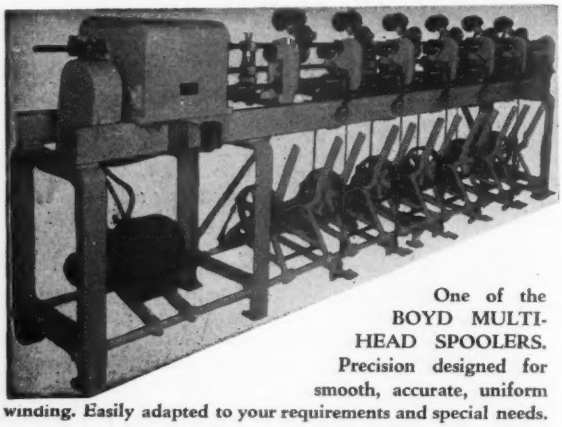
Briefly Described Below Are Only Four Types of Boyd Machines



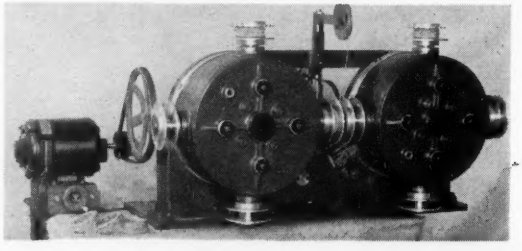
Model No. 1200. HEAVY DUTY SPOOLER designed for spooling or coiling heavy materials on large diameter reels or in coils. Constant speed, versatile and adapted to wide range of reel diameters and traverse widths. Dependable performance; built to last.



Model No. 6000. A rugged BENCH SPOOLER of simple design, precision made for accurate winding. Has one or two spindles, with common traverse, but individual drives. These spindles may be started and stopped independently. Traverse rates and travel may be quickly changed to suit your needs. Can be used for wire, tape, plastics or other materials.



One of the BOYD MULTI-HEAD SPOOLERS. Precision designed for smooth, accurate, uniform winding. Easily adapted to your requirements and special needs.



Model No. 3130. CONTINUOUS COIL WINDER for short coils of 25′ to 200′. When one coil is wound to proper length, heads automatically index to next spindle. A built in knife cuts the wire between the two coils and the complete coil is removed. Speed is variable.

Send for full particulars on these fine BOYD winding machines.

BOYD & SONS MANUFACTURING CO., INC.

1934-38 CALLOWHILL STREET **PHILADELPHIA 30, PA.**

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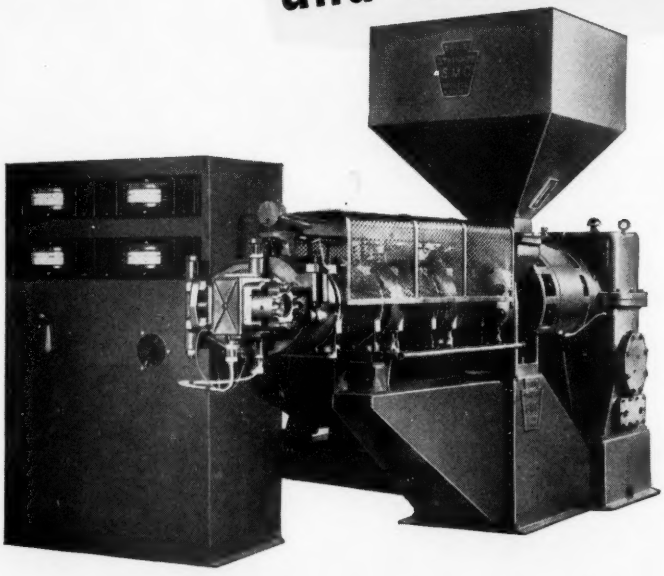
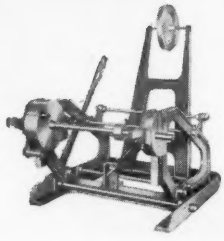
DAVIS-STANDARD and HIGH STANDARD

Go Together



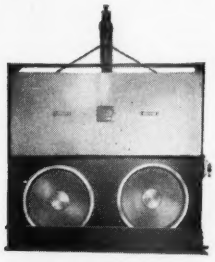
High production standards—in operating efficiency and product superiority are the assured result with Davis-Standard extruding machines. Not only does Standard Machinery give you exclusive features★ found in no other extruders, but it follows through with the necessary auxiliary equipment for complete production satisfaction.

If your standards are high you'll appreciate the performance of Davis-Standards. Our engineers are ready to work with yours to solve any extrusion problem with equipment that does the job *perfectly and completely.*



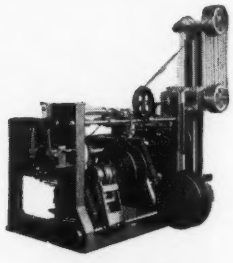
PAY-OFF

Equipped to take reels up to 36" in diameter. Cam-and-lever lift from floor. Mechanism is automatically self-braking, with brake activated by any slackening of wire speed. Rugged construction.



DAVIS-STANDARD CAPSTAN

Drag and pulling type. Supplied for almost all wire plant needs. Aluminum or cast iron drums, grooved or flat, in any radius desired. Gear reducers standard, four-speed transmission optional.



NEW-TYPE TAKE-UP

Great new efficiency. Quiet, vibrationless. No gears or clutches. Operates positively at high speeds. Reel drive by multiple V-belts. Automatic brake. Totally new traverse mechanism. Speed range choice for constant tension control. Built in two sizes: for reels 12" to 24" and 24" to 36".

★ Davis-Standard "Stream-Flo" head assures continuous production at a high rate.

★ Davis-Standard "Therma-Fin" heating jacket (patent pending) permits a broad range of controlled temperatures to be obtained.

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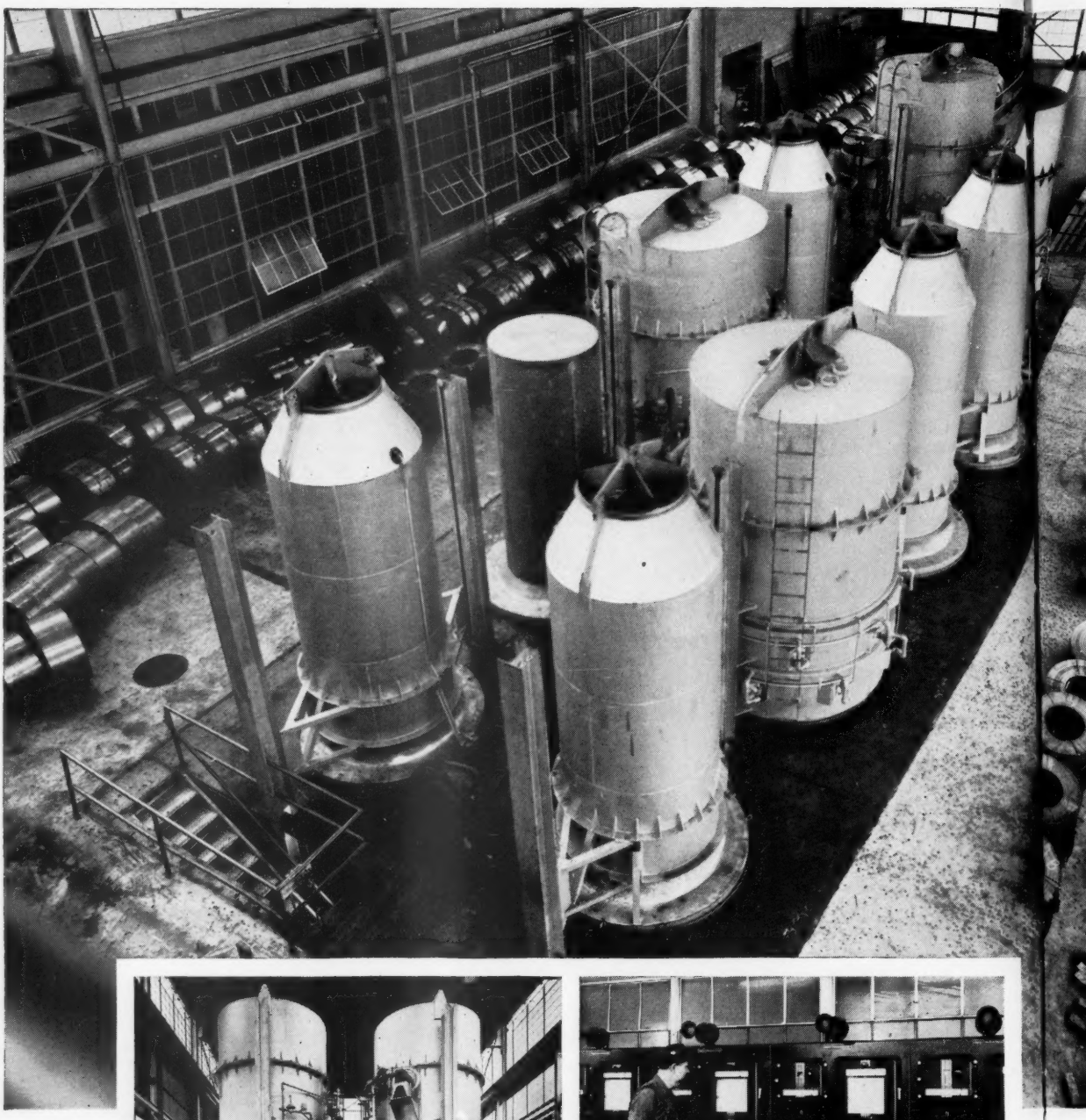
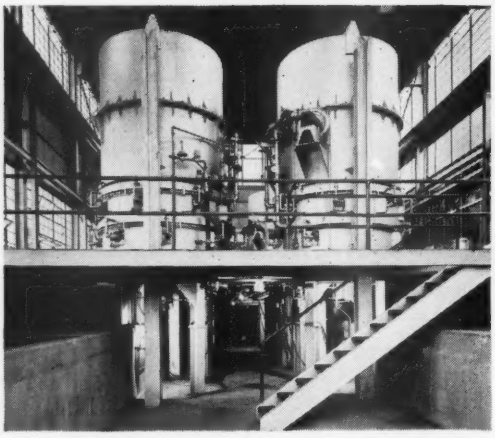
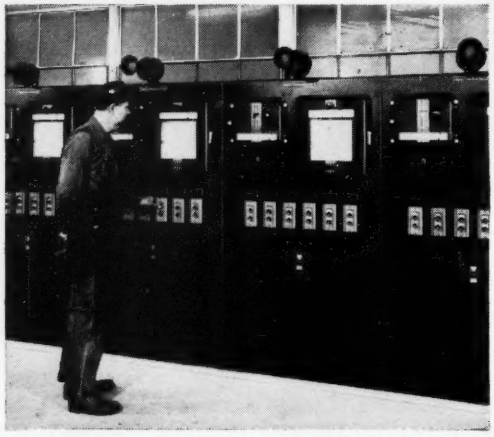
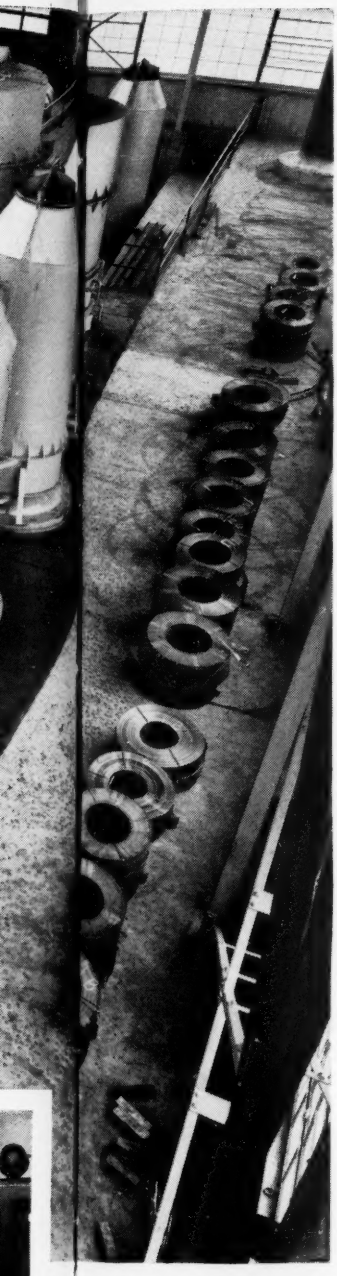




This view shows the sub-mounting arrangement of the Westinghouse Cylindrical Bell-Type Furnace bases. This makes motors and controls easily accessible.



These are the pyrometers and mounting panels at the Thompson Wire Co. that control and indicate the temperatures of the furnaces. Note alarm horns.



"Westinghouse Furnaces stepped up our production"

. . . says Thompson Wire Co.

Thompson Wire Co. is now using four *Gas-Fired* Westinghouse Cylindrical Bell-Type Furnaces, 12 bases, 12 inner hoods, and 8 air-cooling hoods. A fan, mounted on top of each cooling hood, draws air between the work hood and cooling hood, exhausting heated air to the top, thus accelerating cooling of the charge.

This entire new operation has given Thompson Wire Co., greater load per heat, faster cooling, less maintenance costs and increased production.

Investigate Westinghouse Heat-Treating Furnaces with an eye toward cutting costs and increasing capacity.

For more information regarding Westinghouse Heat-Treating Furnaces, write or call your nearby Westinghouse office. Westinghouse Electric Corporation, Industrial Heating Department, Meadville, Pa.

J-10386

YOU CAN BE SURE... IF IT'S

Westinghouse

IF YOUR PRODUCT CALLS FOR HEAT-TREATING...IT CALLS FOR A WESTINGHOUSE FURNACE...GAS OR ELECTRIC

Fastest Process Annealing FOR COILED STEEL WIRE

- ✓ Annealing cycles accomplished in minutes rather than in hours
- ✓ 50% lower equipment cost
- ✓ less floor space
- ✓ no scale, decarburization, or other atmosphere effects

On-the-job production figures prove that no other method compares with an Ajax Electric Salt Bath Furnace in speed, uniformity, cost saving, and general all-around efficiency in process annealing all types of steel wire as well as aluminum, copper alloys, and silver alloys.

Heating cycles are far faster. Absolute uniformity is assured. Thanks to the exclusive Ajax electrodynamic stirring action, the temperature does not vary more than ±5°F. *in any part of the bath.*

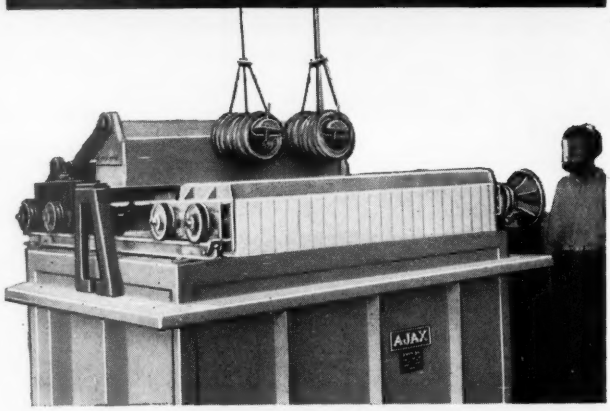
The Ajax Salt Bath eliminates all atmosphere with its accompanying problems of oxidation, pitting, and decarburization. Preservation of metal surface is assured. Equipment cost is much lower —and the Ajax handles more work for a given amount of floor space than any other method. Ajax Reprints 62 and 63 gladly sent on request.

LOW- AND HIGH-CARBON STEELS

This typical Ajax installation process anneals 1200 lb. 18-gauge wire an hour in only 58 feet of floor space.

STAINLESS STEEL

Annealing fine gauge nickel-chromium wire at 1950°F. Clean wire surface eliminates conventional pickling operations.



- **TOPS for WIRE PATENTING, too!**
- **IDEAL FOR DESCALING** hot-rolled stainless and alloy steel wire and other shapes employing either the Dupont sodium hydride or the Hooker Electrochemical Virgo bath.

Associate companies: Ajax Electric Furnace Corp. • Ajax Engineering Corp. • Ajax Electrothermic Corp.

SELF-HEATING • SELF-CIRCULATING

AJAX electric SALT BATH furnaces

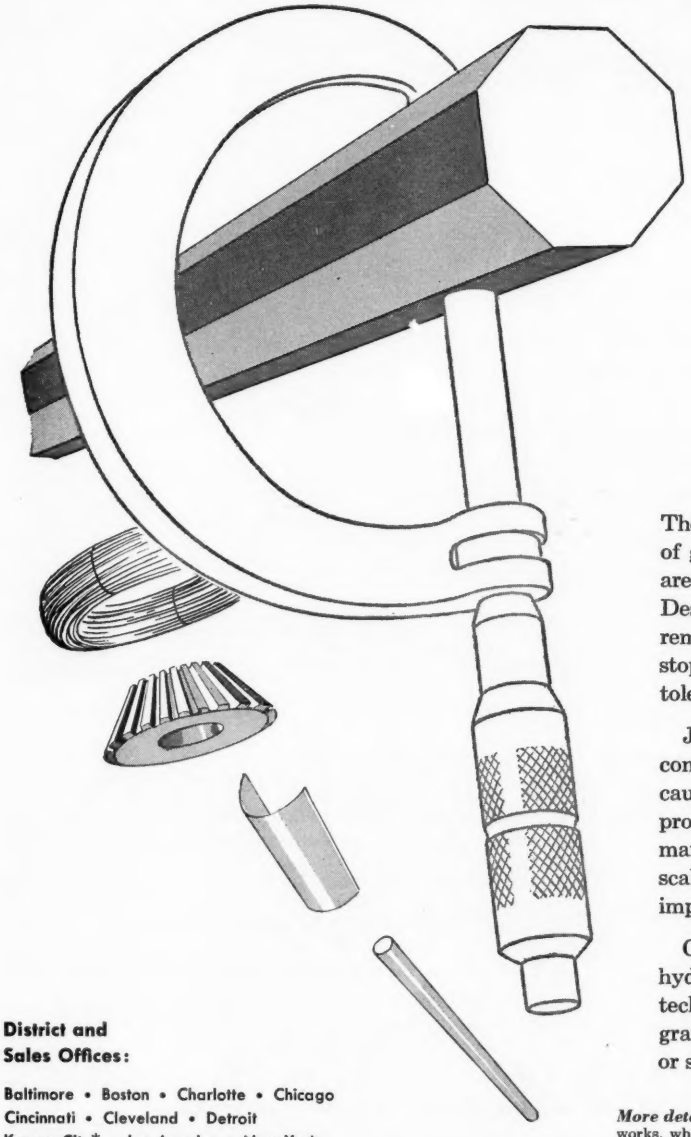
OVER 4,000 INSTALLATIONS . . . more than all other salt baths combined

AJAX ELECTRIC CO., Inc., 928 Frankford Ave., Philadelphia 23, Pa.

Stop Rejects and Costly Base Metal Losses

use the

DU PONT SODIUM HYDRIDE DESCALING PROCESS



High dimensional accuracy for work of all shapes and sizes!

There is *never* any danger of etching, pitting or loss of gauge when stock in process or finished articles are descaled in a Du Pont Sodium Hydride Bath. Descaling action stops the *instant* scale has been removed. This eliminates base metal losses and stops rejects . . . permits you to work to closer tolerances throughout all manufacturing steps.

Just one fast treatment is all that's needed for complete descaling of all metals not affected by fused caustic at 700°-750°F. This speed makes the Du Pont process ideal for production line set-ups, whether manual, conveyorized or continuous. And since all scale breaking operations are eliminated, you get important savings in time, labor costs and floor space.

Get all the facts from Du Pont—pioneer of sodium hydride descaling. Specialists will be glad to provide technical assistance for your metal cleaning program. Just get in touch with our nearest district office, or send in the coupon below.

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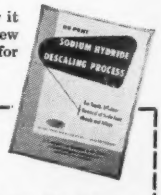
More detailed information about the process—how it works, what it can do for you—can be found in our new book. Call our nearest office or use the coupon below for your copy.



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Electrochemicals Department MP-9
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Sodium hydride process for positive descaling

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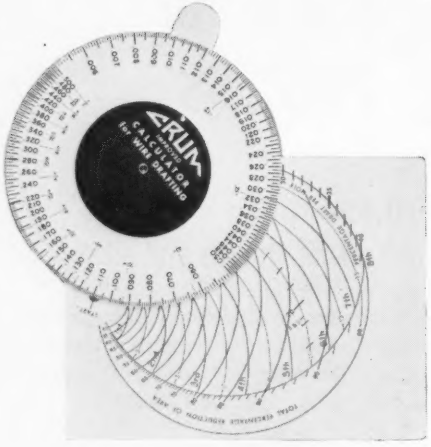
THE NEW IMPROVED . . .

CRUM CALCULATOR

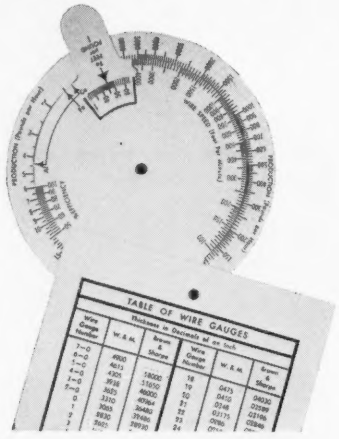
FOR WIRE DRAFTING



Front view of Crum Calculator.

THIS NEW DOUBLE-PURPOSE CALCULATOR WILL:

1. Provide quicker and more accurate information on die sizes and reduction areas;
2. Calculate wire production rates for various speeds and efficiencies.



Reverse view of Crum Calculator.

SOME OTHER FEATURES OF THE CALCULATOR

- Has new scale for more accurate determination of small percentages.
- Gives readings in B & S gauges.
- Intermediate lines provide reductions for 16 holes in one setting.
- New rectangular shaped back for better protection of calculator.
- More legible % draft-per-hole scale.
- Vinyl plastic construction, resistant to wear, warping, dirt, perspiration, wire drawing soaps—can be cleaned.
- Still fits your vest pocket.
- Handy tables of W & M and B & S gauges.
- Feet per pound calculating scale for steel, copper and aluminum wires.
- Durable, accurate, easy to use.

The new Crum Calculator is worth its weight in gold in time saving—no laborious mathematical calculations necessary with this Calculator. Instruction sheet with examples accompany each Calculator. You need one or more.

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Submerged Electrode Furnace with removable electrodes.

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WORKING RANGE 295° F.

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4. This product can be used in Holden Marquenching units and competitive furnaces.

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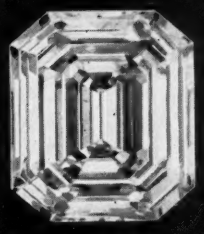

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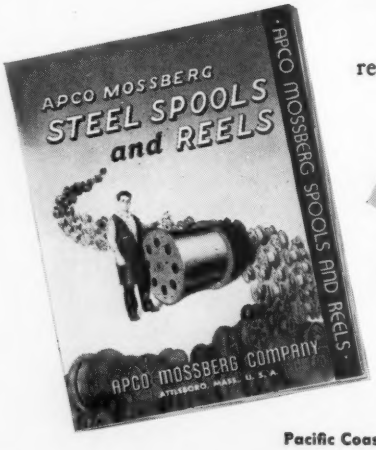
The Apco Mossberg plant is fully equipped to handle your special requirements, if standard types are not suitable for your use.



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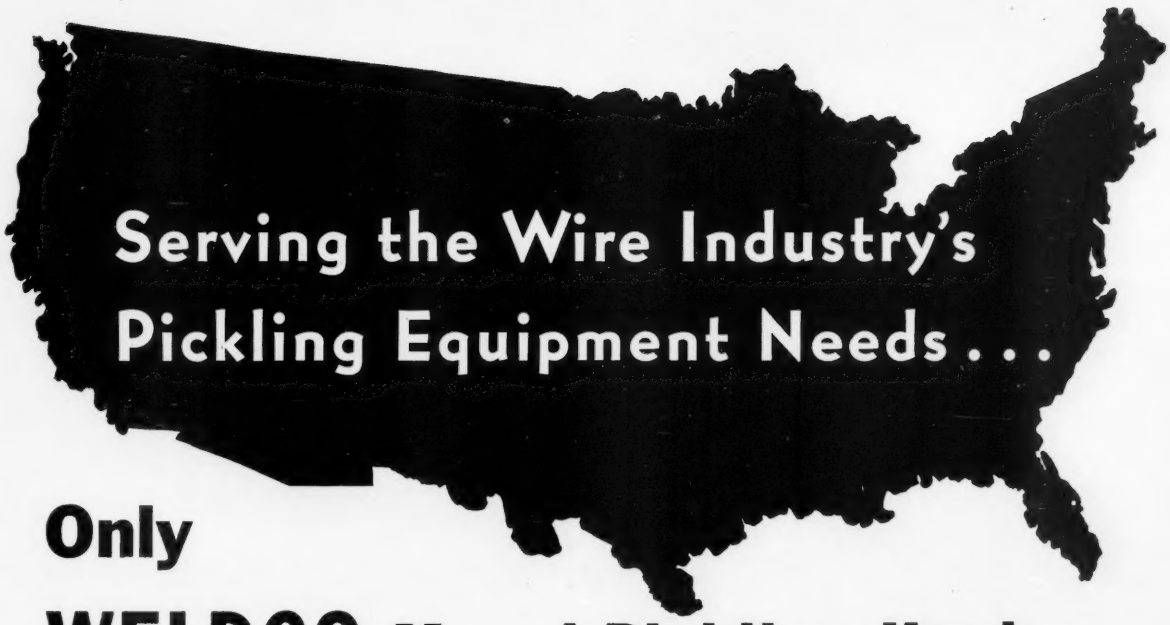

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IN
STANDARD OR SPECIAL SIZES

NATIONAL WIRE

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in Coils or Straight Lengths

COMPLETE METALLURGICAL SERVICE

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Manufacturers of

SPRING WASHERS	RETAINING RINGS
ROUND EDGE FLAT WIRE	KEYSTONE SHAPED WIRE
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Shaped Wire in Coils or Straight Lengths, Ferrous or Non-Ferrous.

LARGE OR SMALL QUANTITIES

Manufactured by

THE NATIONAL LOCK WASHER COMPANY

PRECISION SHAPED WIRE DIVISION

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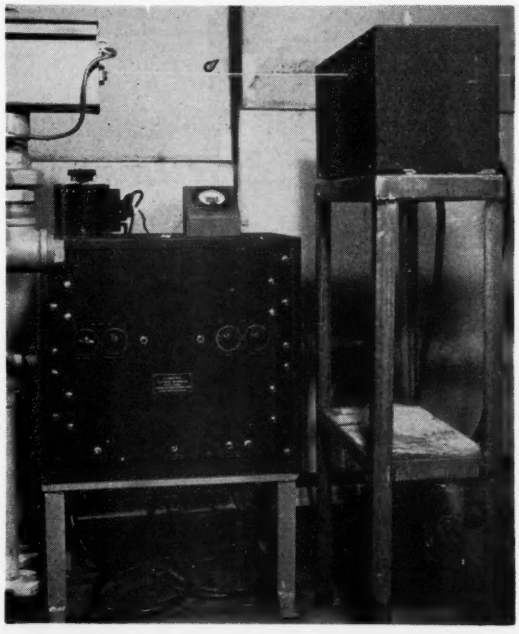
ACCURATE, CONTINUOUS DIAMETER CONTROL NOW POSSIBLE WITH THE

"DIAMACONTROL"

AN ELECTRONIC MICROMETER FOR INSPECTION AND IN-PROCESS CONTROL OF DIAMETERS OF WIRE AND ELECTRICAL CONDUCTORS.

DIRECT READING • NON-CONTACT • CONTINUOUS



On the left is a "DIAMACONTROL" set up for operation in an electric wire plant.

With this instrument the customer has been able to:

CONTROL QUALITY

REDUCE COSTS

REDUCE SCRAP

and REJECTIONS.

Diameter Ranges:
.001" to 1.00"

An important feature of the "Diamacontrol" is the elimination of drift from the original setting. This highly efficient instrument has no speed limit and vibration does not affect the diameter readings, which can be continuously recorded.

You are invited to write for full information or, if you prefer, to arrange to visit us for a demonstration of the "Diamacontrol."

EXCERPTS FROM USERS' LETTERS

"In reply to your inquiry as to how the Diamacontrol is working we are pleased to report that so far we have not found any defects. The sensitivity has not changed and the accuracy is satisfactory. . . . There has been no servicing of the gage since we have had it. Since there has been no change in characteristics, we have not even checked the vacuum tubes."

"Your prospective client called us by telephone and I recommended highly the use of your Diamacontrol. The equipment is operating to our full satisfaction."

"Another customer reports that the Diamacontrol paid for itself in less than 3 months as a result of savings. It was used here on nylon coated wires."

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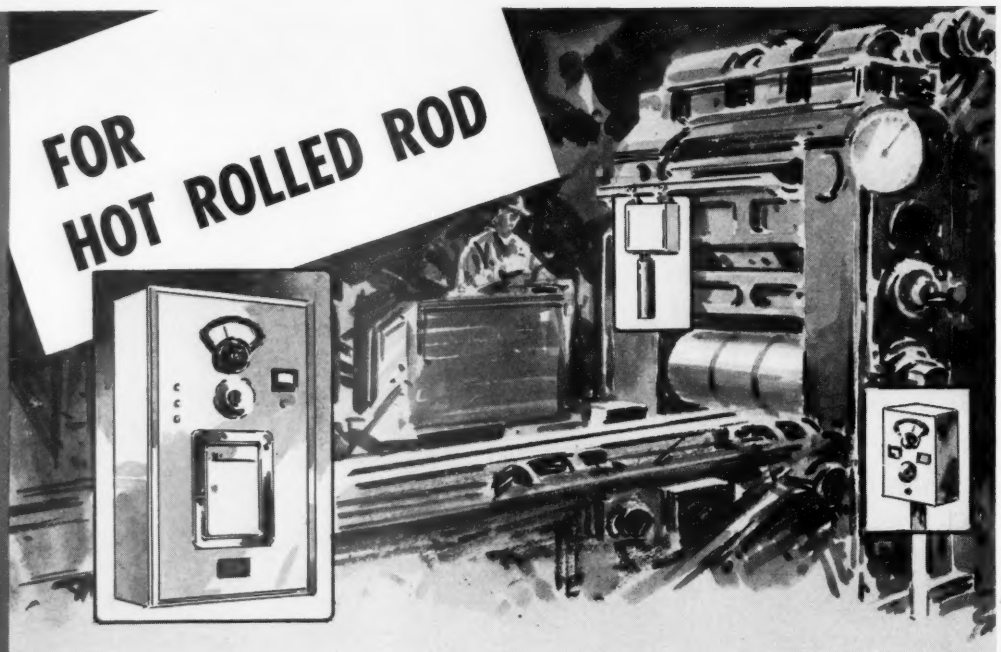
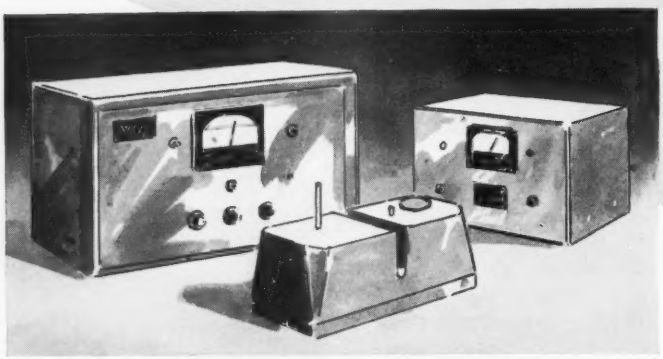
FOR HOT ROLLED ROD



A NON-CONTACT DIAMETER GAUGE

For measuring accurately and continuously the diameter of hot rod as it emerges from the rolling mill. Also detects out-of-round and fins. Accuracy unaffected by temperature variations, oxides or steam.

You are invited to our demonstration at the Wire Association Convention in Chicago.



FOR INSULATED WIRE

A Non-Contact Gauge and Automatic Diameter Control

Find out how you can save time and material with these continuous "in process" MICROLIMIT CONTROLS. One manufacturer reports savings of $1,000.00 per month per extruder on nylon.

Write for Details

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LACLEDE Quality Control

from Start to Finish

Means a Better Wire Product for You

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High Carbon Spring
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Fine and Weaving
Rope
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Bookbinding
Tinned,
Copper Coated
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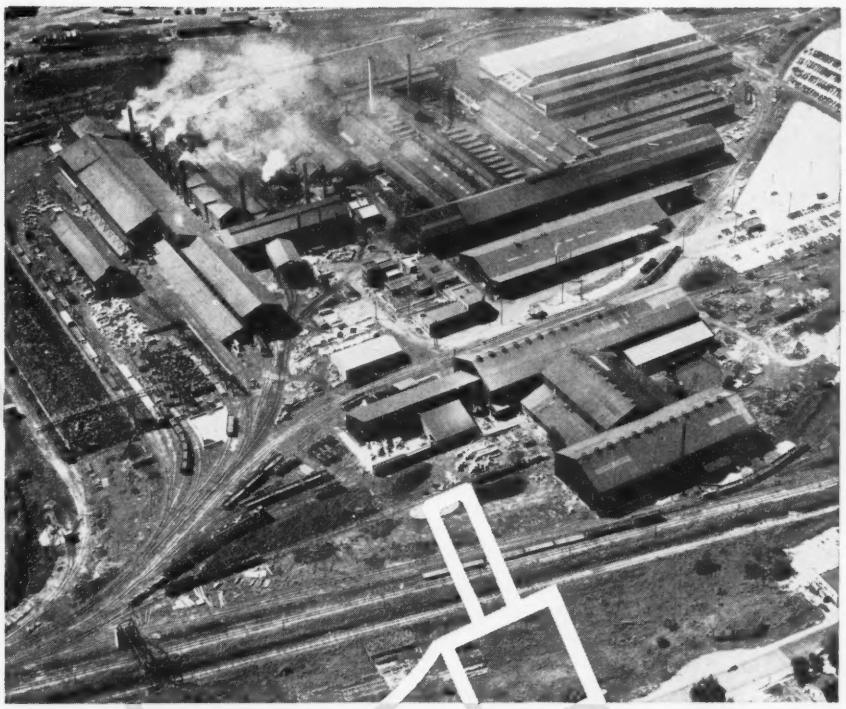
Galvanized



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Alton, Illinois, Works.

From the open hearth to the finished wire . . . Laclede wire is made to your specifications . . . with every step in the manufacture carefully controlled . . . assuring uniform temper, gauge and finish.

Let Laclede engineers and metallurgists aid you in developing wire specifications on these—and many other Laclede quality wires.

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Producers of Steel for Industry and Construction

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P-L-E-N-T-Y... with MEYER, ROTH & PASTOR'S WIRE AND STRIP FORMING MACHINE

UNIVERSAL...
AUTOMATIC...
5 SLIDES, OR MORE...

MEYER, ROTH & PASTOR'S machines mass-produce these and many other parts.

- 5 different size machines for fully automatic, economical production of parts from wire coil or strip stock.
- Various sizes produce from 60 to 300 pieces per minute in wire up to .145" diameter or strips up to 25/32" wide.
- Simplified tooling—machine can be quickly re-set to produce different parts.
- Vertical design takes up little floor space.
- Positive and direct control of the bending slides insures high output and trouble-free operation.
- Roller straightening attachment (7 vertical and 7 horizontal rollers) can be opened—you can feed material without disturbing the roller setting.
- Special gripping device insures uniform feed and does not mark wires or strips.
- 3-speed drive.
- Standard equipment includes 4 forming and 1 punching slide and a complete set of tooling. Additional forming slides and attachments, including a blanking and punching attachment, can be supplied.

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Convention Bound!

This is a picture of us on our way to the ANNUAL WIRE ASSOCIATION CONVENTION, November 9 thru 12 at the LaSalle Hotel in Chicago. Be sure to stop in and see us! We'll be waiting for you with the usual "STEELSKIN" hospitality!

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REDSKIN CRYSTALS
W-BRIGHT GREASE
#5 POWDER
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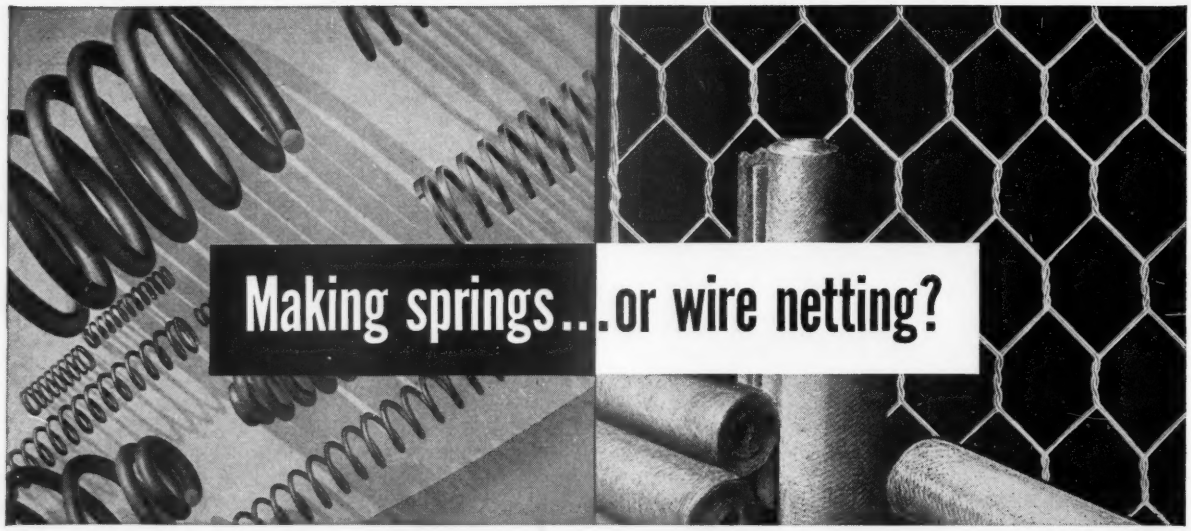
SOAPS AND COMPOUNDS FOR WIRE DRAWING, TUBE DRAWING, DEEP DRAWING AND STAMPING.

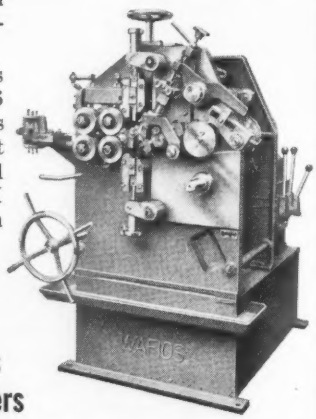


Use the 60 years' experience built into WAFIOS automatic machines

You can produce right and left-hand springs in cylindrical, single and double-cone shapes, both open and close-wound with WAFIOS UNIVERSAL AUTOMATIC SPRING COILING MACHINES. Specially shaped springs, springs with closed ends and torsion springs with shanks can also be manufactured on these machines.

They're compact, accurate, simple and economical machines to operate and easily adjusted; have 2-3 wire feed speeds; 18 to 30 steps for wire length adjustment. Automatic stopping of feed rollers during cutting off. Coiling dies, pitch tool and cutter mandrel can be adjusted during operation.

Type UFM50R handles wire sizes from #19 to #6 AS&WG–produces springs up to 3" outside diameter at rates of about 48, 68 and 88 per minute. Other UFM types for wire sizes from #40 AS&WG to ⅝".



Other Wafios Machines for spring manufacturers

Spring end grinders; simple spring coilers; machines for special tension springs; winders for cylindrical tension and compression springs, bowdencoils, spirals for electrical appliances, baby carriage springs, spirals for spring roller bearings, special section spirals, springs for clothes pegs; looping machines; lock washer machines; torsion spring winders.

Write for Catalog No. 201

WAFIOS MASCHINENFABRIK

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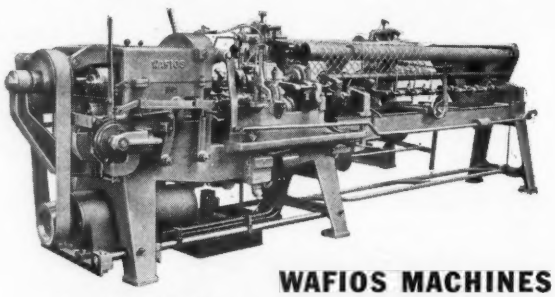
All types of square mesh netting with both edges knuckled or with ends spiral twisted are made on this WAFIOS AUTOMATIC DOUBLE SPIRAL CHAIN LINK FENCING MACHINE. Width of mesh from ⅜" to 2". For wire sizes from 16½ to 9½ AS&WG.

Other sizes and types for automatic and semi-automatic manufacture of chain link fencing in a wide range of mesh widths and wire sizes.



WAFIOS MACHINES for Wire Netting and Wire Mesh Fabrics . . .

Complete equipment for the manufacture of hexagonal, straight line and triangular mesh wire netting.

Automatic machinery for the manufacture of barbed wire and staples.

Round mesh weaving machines for the manufacture of 1-, 2- and 3-ply round mesh weaving for mattresses and other applications. Manual, semi-automatic and automatic types. Also used for crossed and interwoven mesh for many other applications.

Wire crimping machines in manual and automatic types.

Assembling looms for the manufacture of crimped mesh from crimped wire.

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to CHICAGO for
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STANDARD has put out the welcome sign for all visiting wire men, their wives and friends.

We will endeavor to help make your convention as pleasant as possible.

You are cordially invited to visit us in
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Our headquarters will open on Saturday night, November 7th and remain open thereafter throughout the Convention. A hearty welcome awaits you.

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STANDARD INDUSTRIAL COMPOUNDS COMPANY has pioneered most of the outstanding contributions to better wire drawing through better lubricants. Consult with STANDARD for the solution of your difficult problems. We welcome your inquiries.

wire drawing lubricants

Standard INDUSTRIAL COMPOUNDS CO., INC.

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Prompt attention is given to all inquiries. Send us prints or parts for estimating and recommendation.
Ask for Catalog 52-G.

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TUNGSTEN ALLOY HEAVY-METAL
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

KNOW WHAT YOU GET

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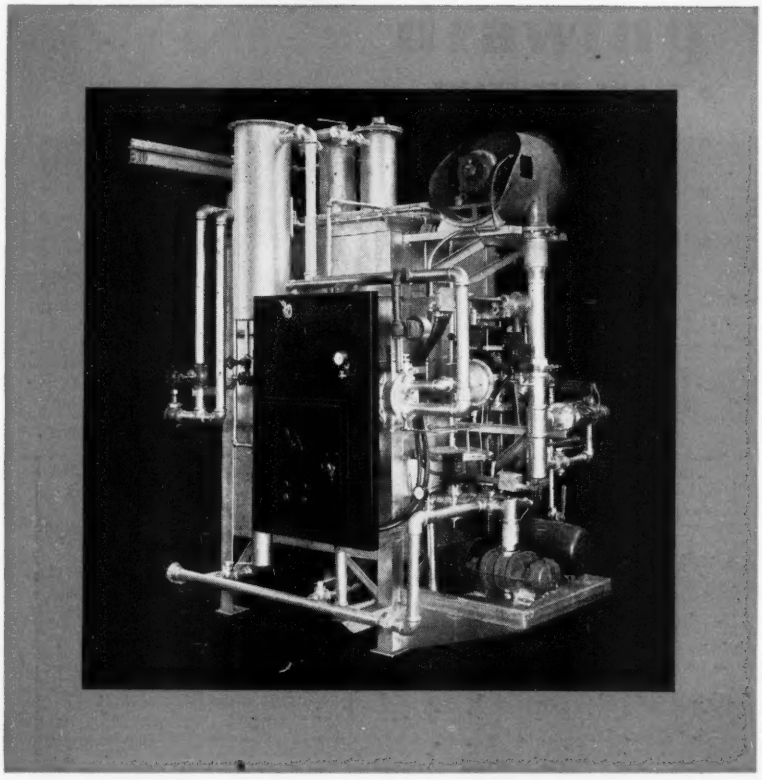

There's a fourth dimension in every atmosphere generator, which makes a significant difference in Heat Treat productivity and equipment earning power. It's the number of *previous successful applications* which, in the case of Surface generators, runs literally into thousands. Indeed, they go back to 1929, the year of the first use of a neutral atmosphere for controlling oxidation of non-ferrous metal. If you want the best guarantee that specifications will be met or exceeded, specify 'Surface.' The latest and most authoritative data on gas atmospheres are presented in our bulletin SC-155. We'll be glad to send you a copy.

***Specify* SURFACE COMBUSTION ATMOSPHERE GENERATORS**

See Surface exhibit, "FROM INGOT TO FINISHED PRODUCT," Booth 321, Metal Show.

POCKET-GUIDE

TO GAS ATMOSPHERES

FOR ALL REQUIREMENTS

GAS	CAPAC. c.f./hr.	APPLICATIONS
RX	250 to 5600	carburizing, dry cyaniding, brazing, sintering, bright annealing, clean hardening, carbon restoration (skin recovery)
DX LEAN	250 to 35,000	bright annealing and sintering (copper)
DX RICH	250 to 35,000	bright annealing, brazing (low and medium carbon steel)
NX	2500 to 20,000	bright annealing (copper, carbon steel), clean hardening (medium carbon steel)
HNX	5000 to 20,000	extra bright annealing (copper, low carbon steel), clean annealing (stainless steel)
AX	100 to 4000	rapid de-oxidation of surface metal, brazing, sintering (low carbon steel), bright annealing (stainless)
HX	1000 to 15,000	rapid de-oxidation of surface metal (low carbon steel), bright annealing (stainless)

This condensed table of Surface Combustion prepared atmospheres (designations are trademarked) shows at a glance how broad a range of heat treat requirements they meet. Specified gas compositions are accurately and economically maintained, over the entire range of capacities. Your nearby Surface representative can draw from an unequalled fund of industry-wide experience, and recommend equipment best suited to your job. Bulletin SC-155 presents 8 solid pages of valuable data.

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HEAT TREATING EQUIPMENT

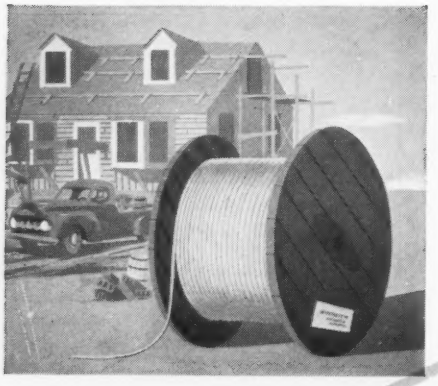
SURFACE COMBUSTION CORPORATION • TOLEDO 1, OHIO

ALSO MAKERS OF

Kathabar HUMIDITY CONDITIONING Janitrol AUTOMATIC SPACE HEATING

Electrical wire and cable coatings

Call for CELLUFLEX* 179C



- **FLAME RESISTANT**
- **HIGH DIELECTRIC STRENGTH**
- **LOW WATER AND OIL EXTRACTION**
- **RAPID FUSION**

DESCRIPTIVE DATA

CELANESE* PLASTICIZER	GRADE	APPEARANCE	COLOR APHA Max.	SPECIFIC GRAVITY @ 20/20° C.	ACIDITY	ESTER VALUE % Min.	PERMANGANATE TIME, Min. (in Minutes)	REFRACTIVE INDEX @ n $\frac{25° C.}{D}$
LINDOL* tricresyl phosphate coal tar base	Technical	Clear transparent liquid	50	0.986 ± .002	0.01 (2)	98	—	1.485
CELLUFLEX* 112 a mixed ester	Technical	Clear transparent liquid	75	1.165 ± .005	0.01 (3)	99	30	1.553
CELLUFLEX* 179C tricresyl phosphate petroleum base	Technical	Clear transparent liquid	150	1.165 ± .005	0.01 (3)	99	30	1.553
CELLUFLEX* TPP triphenyl phosphate	Technical	White flakes	20(4)	1.202 ± .005(1)	0.003 (3)	99	30	1.550(1)
CELLUFLEX* DBP dibutyl phthalate	Technical	Clear transparent liquid	50	1.045 ± .001	0.01 (2)	98	—	1.490
CELLUFLEX* DOP dioctyl phthalate	Technical	Clear transparent liquid	40	1.210 ± .005	0.01 (3)	99	30	1.560

(1) @ 60° C. (2) % as phthalic, max. (3) % as phosphoric, max. (4) molten.

Celluflex 179C—tricresyl phosphate, commercially developed by Celanese — is the standard of comparison among flame-resistant plasticizers for electrical applications. It has very low volatility, excellent solvent power, a high degree of permanence ...producing tough flexible vinyl coatings for transformer wires and electrical cable.

Celanese, pioneer in the production of petroleum-based and coal tar-based tricresyl phosphate plasticizers, today offers an expanding list of Celluflex plasticizers designed to fit a broad range of applications. Celanese Technical Service and Application Laboratories are fully equipped to assist you in formulations and test. Bulk stocks of Celanese Plasticizers are maintained at centrally located distribution points for prompt delivery. Wire manufacturers can take advantage of price differential and freight saving by ordering combination shipments—compartmented tankcars, tankwagons, or mixed drum carloads.

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Celanese Corporation of America
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Wire drawing machines

"Always reliable!" . . . was the operator's remark about this wire-drawing machine which has continuously produced steel-wire for our customer every single working-day for 12 years.

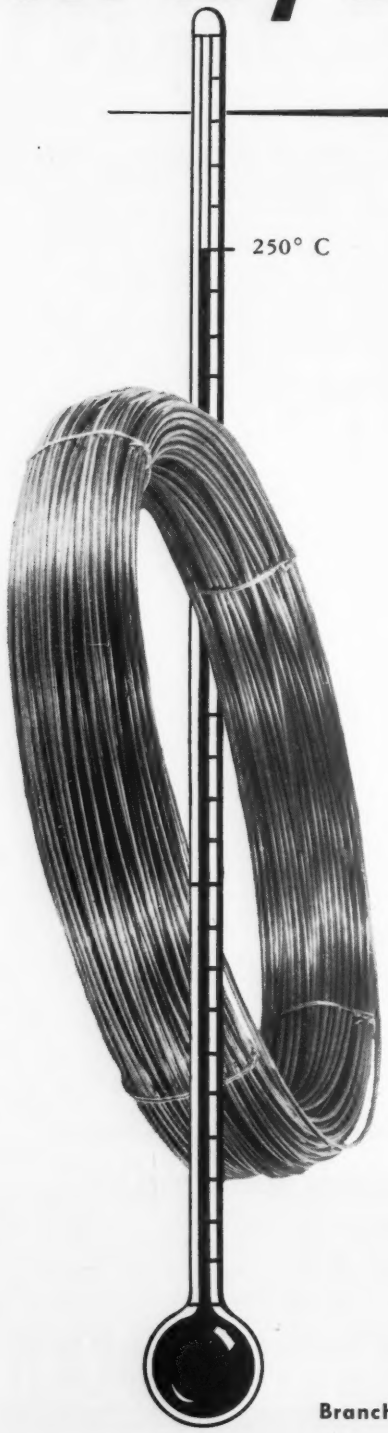
We manufacture drawing machines for drawing wire from rod max. ¾" down to 0.005" diameter of any ordinary material — ferrous and non-ferrous metals — and fitted with one or several blocks. May we have your inquiry?

MH

MORGÅRDSHAMMAR

MORGÅRDSHAMMARS MEK. VERKSTADS AB · MORGÅRDSHAMMAR · SWEDEN

New, Superior Lubricant for dry drawing steel wire



NOPCO* DD

NOPCO DD, new, specially processed lubricant for dry drawing high and low carbon steel wire, can solve many of your dry wire drawing problems.

NOPCO DD is a modified fused calcium stearate type lubricant with an exceptionally high melting point. At temperatures over 250° C., NOPCO DD becomes softer and somewhat plastic, but never becomes fluid. This results in greater adherence to the surface of the wire, even under the most severe drawing conditions—which means better lubrication, longer die life, better wire.

NOPCO DD is of particular value in deep drawing operations, and drawing hard alloys—let us send you complete details and samples for testing.

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PROGRESS WITH THE *Trauwood* PROCESS

FOR PATENTING, ANNEALING AND OIL-TEMPERING OF FERROUS, STAINLESS AND OTHER ALLOY STEEL WIRE & STRIP

TRAUWOOD'S OUTSTANDING NEW DEVELOPMENT IN ELECTRIC DIRECT RESISTANCE HEATING COMMANDS THE FOLLOWING IN UNPARALLELED PERFORMANCE:

QUALITY, UNIFORMITY, LOW-COST OPERATION

The Trauwood Process produces the finest heat treatment possible and thereby develops the maximum physical and fatigue properties; and with an insured consistent uniformity from day to day now greater than ever with the newly developed addition to the time proven and accepted Trauwood Process.

FASTER PRODUCTION FULLY AUTOMATIC

The Trauwood Process heats the wire by passage of electric current through it. No other method in science can heat it more rapidly or with more uniformity. Coupled with this, the heated wire is quenched on a rising temperature—the theoretically desired is attained with the Trauwood Process.

BROAD THERMAL RANGE ACCURATE CONTROL

The Trauwood Process gives control and range of wire heating temperatures within the accuracy and range of present temperature control instruments. Very fine temperature adjustments at high or low temperatures are obtained quickly and with consistent repeatability, since electricity is so easily controlled.

CAN BE DESIGNED FOR ALL SIZES AND TONNAGES

Trauwood electric direct resistance heat-treating equipment is in operation in wire and strip industries all over America and in 7 foreign countries.
Whatever the requirements—the Trauwood Process is applicable.

ALL OF THIS—IS YOUR COMMAND OF PROGRESS WITH THE TRAUWOOD PROCESS.

Send now for full information.

THE TRAUWOOD ENGINEERING COMPANY

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IF you make sieves or staples, screws or screens—whatever you make that takes wire—we're pretty sure to have the kind of manufacturers wire you need. Round, flat, square . . . hard, soft, ductile . . . plain, tinned, or bright finished . . . carbon, alloy, or stainless. Altogether we produce over 400 different types of wire which are suitable for practically all everyday wire applications.

But, if you need a special kind of wire, we can supply that too. Our modern plant facilities enable us to draw wire to meet the exact specifications of a special order, and our trained metallurgists are always ready to assist you with any manufacturing problems you may have.

We've been in the wire-making business more than one hundred years, and all of our experience is at *your* service . . . to help you do an easier and better fabrication job.

If you make it of wire... make it of the best!

U·S·S AMERICAN MANUFACTURERS WIRE

AMERICAN MANUFACTURERS WIRE

AMERFINE—*High-quality fine wire.*

AMERSPRING—*music steel spring wire.*

AMERLOY—*alloy heading wire.*

AMERTEMP—*heavy-duty oil-tempered wire.*

AMERHEAD—*uniform heading wire.*

AMERSTITCH—*extra-tough metal stitching wire.*

USS TRADE MARK

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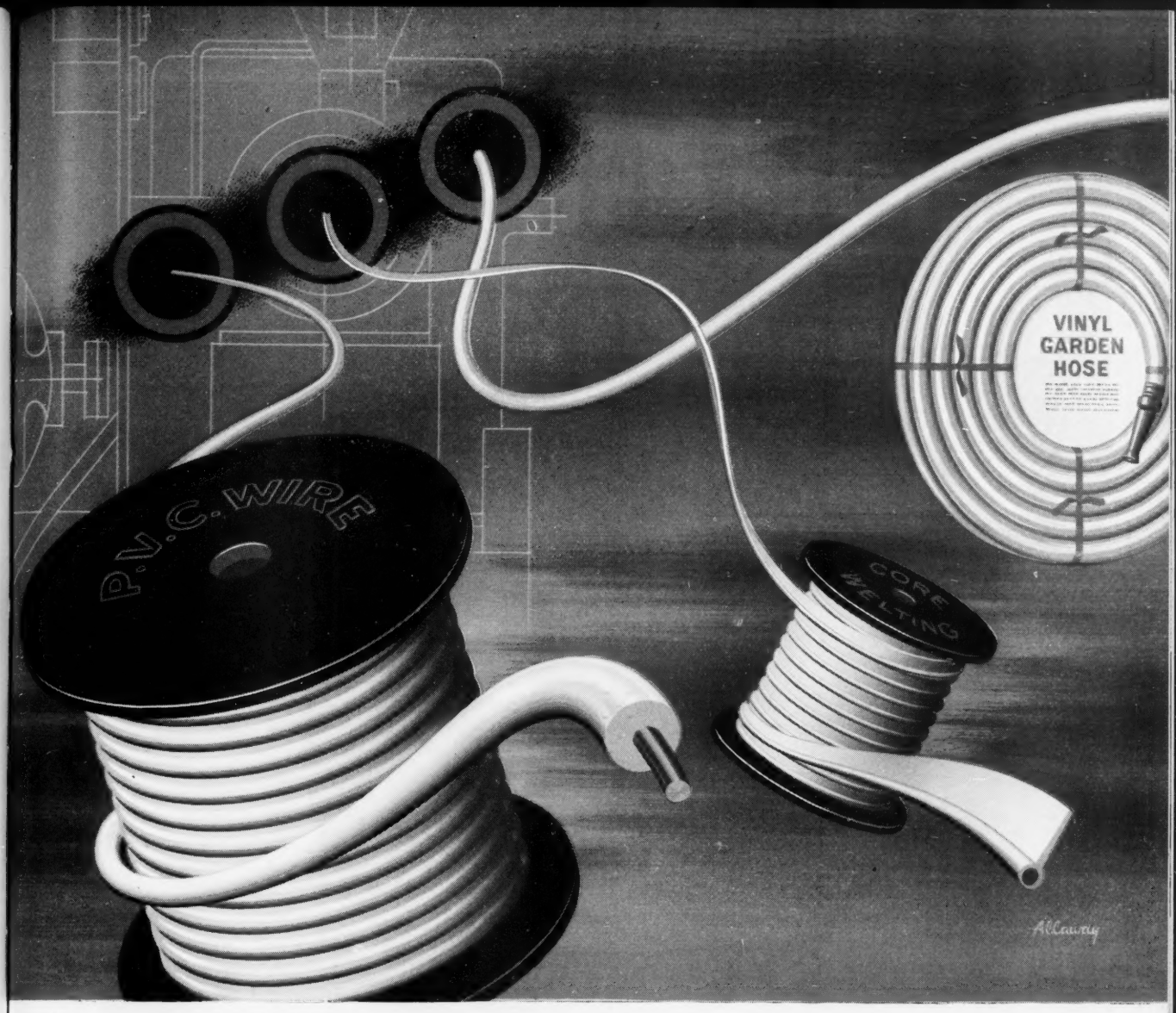

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The Wire Outlook

Welcome to the Convention!

The directors and officers of The Wire Association extend their cordial greetings to the wire men who are planning to convene in Chicago next month for what now appears to be the most rounded and complete program of technical papers so far assembled for the benefit of our progressive industry. It will be their pleasure to renew old friendships and make the acquaintance of the many new members who are coming—especially those of non-ferrous interests whose numbers in the Association's roster is growing rapidly.

Personal incomes this year may set an all-time record and unemployment has dropped to a new post-war low. Personal incomes for the first seven months of this year exceeded a like period in 1952 by over 19 billion dollars. Labor scored most of the increase, with business and professional workers showing only slight gains. Farm incomes were 10% off in 1953.

Farmers' spending for new equipment, fencing and building has dropped, not just because their incomes are not as high, but somewhat due to doubt as to the trend. Residential and industrial construction is down, but commercial building sharply up. Radio and T.V. production is higher, with household appliances off. Auto production, low in the summer, has picked up. Airplane cut-backs affect future orders only and current back-logs will keep manufacturers busy well into 1954. There is much evidence to indicate that consumer spending will carry through the holiday season at high levels. It is expected now that the boom will begin to taper off next year, but not to serious levels. While it is difficult for industrialists to secure all the help now wanted, it is hardly reasonable to expect this condition to continue indefinitely.

We have called attention to the growing danger of continued wage increases. Right now, with further demands in prospect for 1954, labor may be pricing the products it makes out of markets. It must be recorded that imports of machinery, rods, wire and wire products are increasing for the very simple reason that most foreign products are cheaper and fabricators are entering upon a highly competitive era. And lower tariffs are being sought!

Sales of electric wire and cable are termed "spotty." Brass mill business is something more than 7% down from the average of the first half. Except for some high carbon wire specialties, forward wire buying is light. Music wire is readily available from many sources. Fasteners have become slow-moving.

Along with all of this, new machinery and equipment sales are holding strong. To anyone who visits wire mills it is readily apparent that in most of them there is still much obsolete or near obsolete equipment in use. In competitive times it becomes more than ever important to management to replace less efficient machines with modern ones—this trend should therefore continue.

The dip in farm spending of approximately 10% almost exactly corresponds to what they have lost in income. While some of this curtailment is psychological, it is an excellent illustration of the country's need for lower taxes. As taxes recede, which we hope they will, a flood of new purchasing power will be released to the degree of the reduction.

While it is never pleasant to contemplate lower levels of business, we have been in a period of inflation caused by war and fear of greater wars. We can continue to prosper—and shall. Meanwhile the overall business barometer is for fair weather for the balance of the year. Most businessmen are finding that sales are much better than they expected.

—from the Editor's Desk

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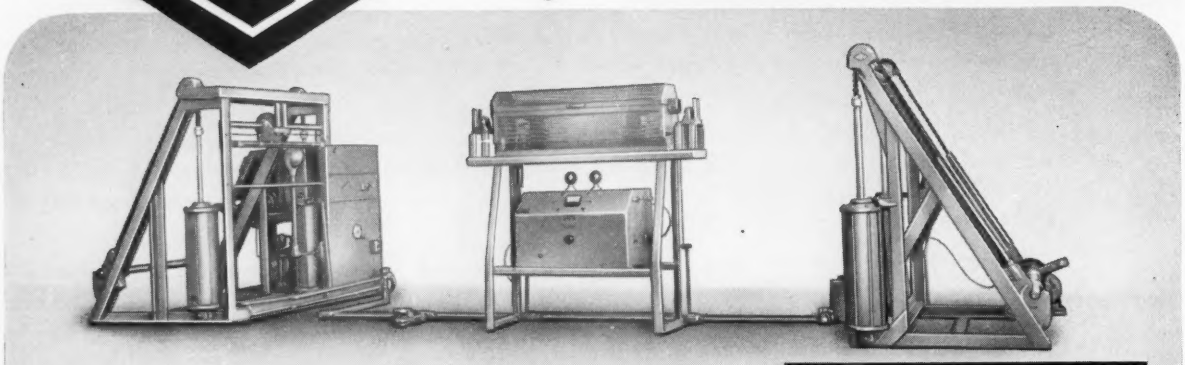

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DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 28 OCTOBER, 1953 No. 10

A Nickel-Free Austenitic Steel For High-Strength Wire

by H. O. McIntire, Asst. Chief and G. K. Manning, Chief
Metallurgical Engineering Division
Battelle Memorial Institute
Columbus, Ohio

Development of an alloy low in scarce elements and suitable for drawing into nonmagnetic wire of high strength is discussed. The alloy has drawability, strength, electrical, and magnetic properties comparable to those of Type 304 stainless steel. Satisfactory percentage compositional limits are as follows: C .08/.15, Cr 9.0/11.0, Mn 14.5/18.5, S1 0.3/1.3, Cu 1.8/2.2, N_2 .08/.15, and bal. Fe.

Attempts to use lower contents of manganese and chromium with higher levels of carbon were unsuccessful because of the poor drawability of the alloys.

This paper was prepared for presentation at the Annual Convention of The Wire Association on November 9, 1953, in Chicago, Ill.

Introduction

A light weight communications cable, developed for the **Army Signal Corps,** was described in the June, 1953, issue of **Wire and Wire Products.** This cable, popularly called Spiral-four cable, contains a braid made from 16 strands of cold-drawn Type 302 or Type 304 stainless steel wire. The purpose of the braid is to provide the strength required in the cable. Individual wires of the braid are 0.015 inch in diameter and have a nominal tensile strength of 300,000 psi.

★ ★ ★

To achieve the results desired, from the communications standpoint, it was found necessary for the braid wire to be relatively nonmagnetic and to have low electrical conductivity. Of the commercial materials available when the cable was developed, only the chromium-nickel stainless steels such as Type 302 or Type 304 met these requirements. Because the braid is incased in an outer cable jacket, however, the stainless quality of these steels is not essential. As all available chromium and nickel are needed for applications where corrosion resistance is of primary importance, **Signal Engineering Laboratories,** Fort Monmouth, N. J. asked **Battelle Memorial Institute** to undertake the development of an alternate for chromium-nickel stainless in this particular application. The substitute alloy would need to have strength, flexibility, magnetic, and electrical properties similar to those of cold-drawn stainless steel. It must, however, contain appreciably less of the scarce alloying elements particularly nickel.

Experimental Work

At the outset of the program it was apparent that a satisfactory substitute for stainless steel in Spiral-four cable would need to be an iron-base alloy. Although titanium or zirconium alloys may eventually be developed which will meet the requirements for the cable, they will not be available in sufficient quantities for a number of years. Other nonferrous materials such as copper- or aluminum-base alloys do not approach the strength required and, in addition, have high electrical conductivities.

★ ★ ★

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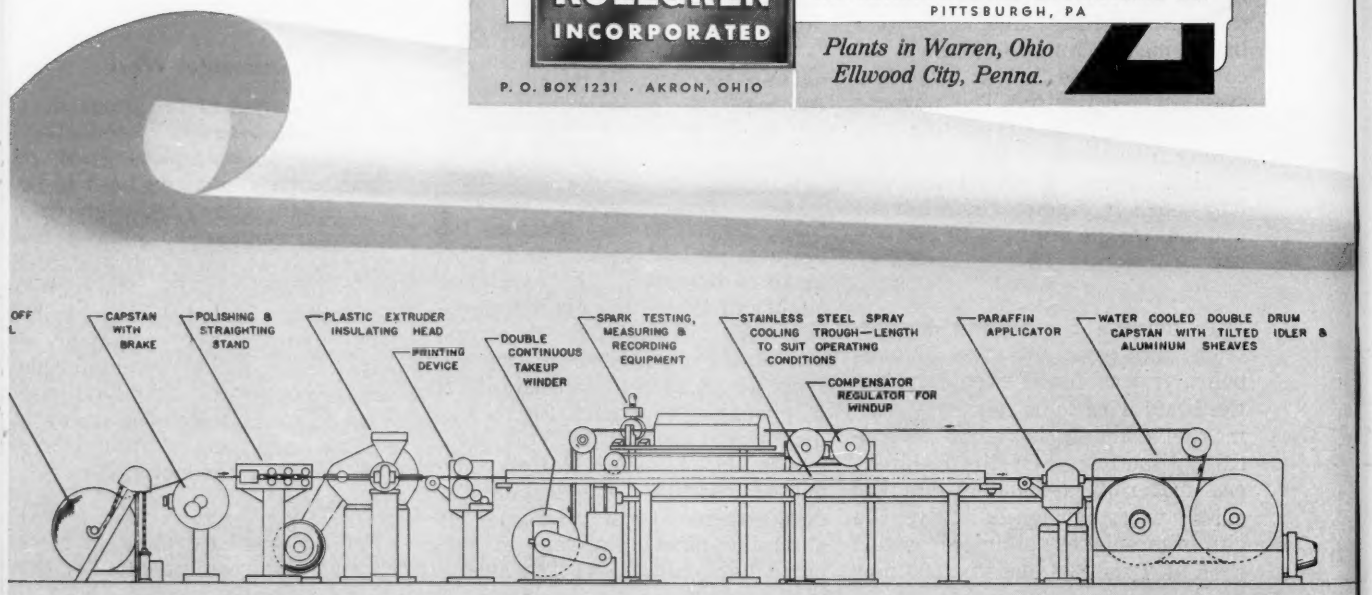
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STAINLESS STEEL SPRAY COOLING TROUGH—LENGTH TO SUIT OPERATING CONDITIONS
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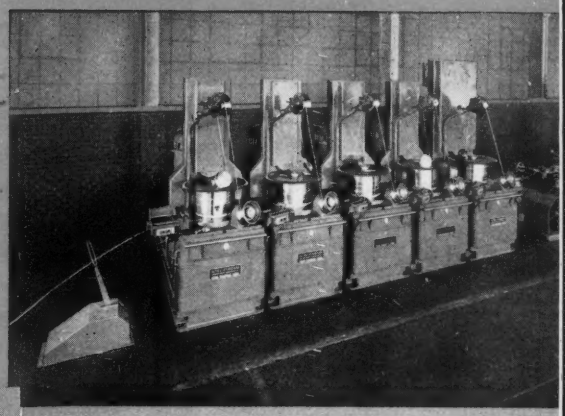
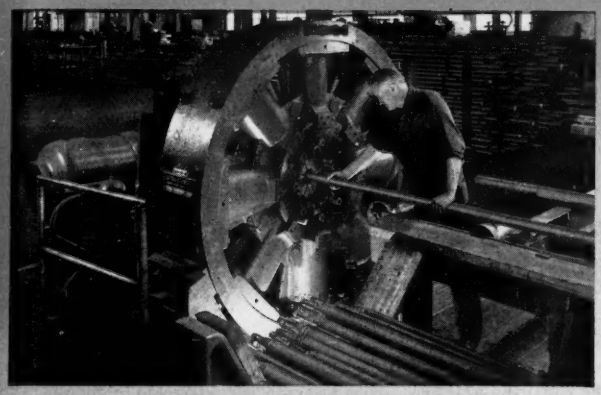


Wire drawing machines, single draft or multi-draft



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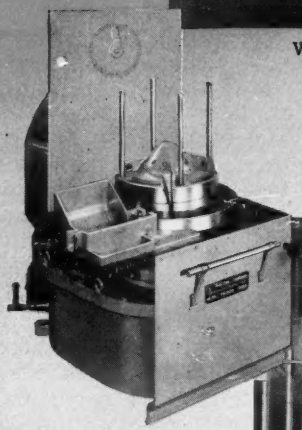
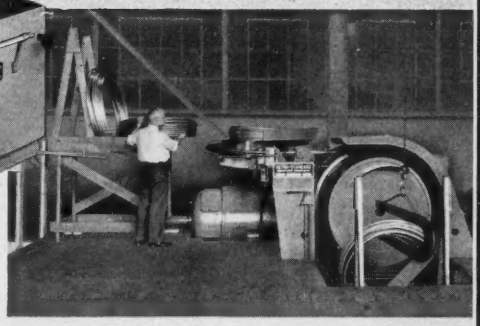
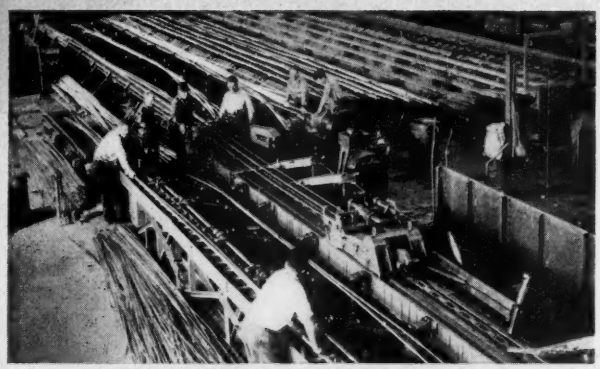


Available die pull capacities: 20,000 lbs., to 40,000 lbs.

Available die pull capacities: 2,000 lbs., 4,000 lbs., 8,000 lbs., 16,000 lbs.



Bull blocks for rod or tube drawing.



Drawbenches—for bars or tubes; single, double or triple draw; die pull capacities to 300,000 lbs.

The last 10 years have been a period of continuous advance in cold drawing. Most of the design and mechanical improvements introduced in this period originated with Aetna-Standard.

Here, for example, are some of the outstanding achievements of Aetna-Standard: the one-man drawbench; drawbenches for triple drawing of tubes; hydraulic squeeze pointer; horizontal bull block; high speed piercing mills; wire drawing machines utilizing vertical unit construction and auto-rheostatic control.

All of these have originated in the research and engineering departments of Aetna-Standard.

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cable, it must be essentially an austenitic alloy, ferritic alloys being highly magnetic. Magnetism values obtained on individual stainless steel wires taken from satisfactory cable ranged from 1 to 26 as determined with an Amminco-Brenner Magne Gage. With this instrument a zero reading indicates a magnetic permeability of 1. For comparison, readings obtained on ferritic Type 430 stainless and on high-carbon wire were 87 and 98, respectively.

★ ★ ★

Listed according to decreasing availability, elements which promote retention of austenite at normal temperatures are: carbon, nitrogen, manganese, copper, chromium, and nickel. Thus, the ideal alloy from the standpoint of cost and availability would be an iron-carbon alloy.

★ ★ ★

The range of alloy compositions covered in this investigation can be conveniently grouped under the following headings:

1. **Carbon-manganese-iron alloys.**
2. **Carbon-chromium-manganese-iron alloys.**
3. **Chromium-manganese-iron alloys with minor amounts of other elements such as carbon, nitrogen, and copper.**

Carbon-Manganese-Iron Alloys

Carbon-manganese-iron alloys have been used for many years in applications where toughness combined with high wear resistance is required. Usually these alloys contain about 1 per cent carbon and 12 to 13 per cent manganese. They are nonmagnetic, but because of their high rate of work hardening, they are not attractive for production of fine, cold-drawn wire. However, it was not certain during the early part of this program that nickel would continue to be available for use in Spiral-four cable and an alternate material was needed immediately in case an emergency should arise. For this reason, a few heats of carbon-manganese-iron alloys were made and their amenability to cold drawing was determined.

★ ★ ★

The alloys were made as six-pound induction-furnace melts.

TABLE 1. CARBON-MANGANESE-IRON ALLOYS

Alloy	Composition, per cent(1) C	Mn	Cu	Mo	Magne Gage(2) Hot Rolled and Annealed	Magne Gage(2) Drawn 50% Red. in Area	Knoop Hardness, 500-gram load Hot Rolled and Annealed	Knoop Hardness, 500-gram load Drawn 50% Red. in Area	Maximum Reduction, %
3	1.2	12.0	—	—	0	0	202	600	66
6	1.2	13.0	3.0	—	0	0	219	580	65
7	1.2	13.0	3.0	1.0	0	0	184	580	66
36	1.2	16.0	—	—	0	0	234	630	56
1	0.3	18.0	—	—	0	4	211	580	53
39	0.3	16.0	—	—	0	68	265	—	35
40	0.1	16.0	—	—	0	85	260	435	81
41	<0.1	16.0	—	—	1	94	244	455	81

(1) Silicon was about 0.3 per cent.

(2) Magnetism was determined with an Amminco-Brenner Magne Gage.

The resulting ingots were forged to ¾-inch square bars which in turn were hot rolled to ¼-inch-diameter rod. To obtain an indication of their drawability the rods were drawn through successively smaller dies until breakage at the die prevented further reduction. Drawing was carried out on a draw bench, using reductions from 42 per cent down to 10 per cent per die, until repeated breakage established the limit of drawability.

★ ★ ★

Alloys having carbon contents from <0.1 per cent to 1.2 per cent and manganese from 9 per cent to 18 per cent were investigated. Composition and properties of some of these alloys are given in Table 1. The alloys forged and rolled satisfactorily and in most instances were completely nonmagnetic after hot rolling. The high-carbon alloys, for example 1.2 per cent carbon-13 per cent manganese, did not become magnetic as the result of cold drawing, but they did harden excessively, so that after 50 per cent reduction in area they were of about the same hardness as "18-8" chromium-nickel steel after drawing 90 per cent.

★ ★ ★

The maximum amount that any of the high-carbon alloys could be drawn without annealing was about 66 per cent. This would require an excessive number of anneals, possibly 5 or 6, for reducing ¼-inch rod to 0.015-inch diameter. In drawing "18-8" to 0.015-inch diameter, 2 intermediate anneals are normally used.

★ ★ ★

Drawability of the carbon-manganese-iron alloys did not improve with changes in composition until the manganese content was increased to 16 to 18 per cent and the carbon was reduced to 0.1 per cent or less. These latter alloys showed about the same work-hardening rate and approached the drawability of "18-8" stainless, but they became highly magnetic as the result of cold working.

TABLE 2. CARBON-CHROMIUM-MANGANESE-IRON ALLOYS DRAWN IN THE AUSTENITIC CONDITION

Alloy No.	Composition, Per Cent C	Cr	Mn	Magne Gage Hot Rolled and Annealed	Knoop Hardness Hot Rolled and Annealed	Maximum Reduction, %
90	0.8	2.0	10.0	0	242	40
89	0.8	6.0	7.5	0	258	43
88	0.8	10.0	4.5	0	312	25
78	0.5	2.0	9.5	4	319	15

Carbon-Chromium-Manganese-Iron Alloys

Another classification of alloys studied contained up to 10 per cent manganese or chromium, and 0.5 or 0.8 per cent carbon. Some of the alloys within this compositional range and the results obtained are given in Table 2. Most of the alloys within this compositional range were completely austenitic. However, they became brittle rapidly during cold drawing, and the maximum amount that any of them could be drawn was about 43 per cent. The alloys did not become excessively magnetic. They broke at relatively low hardness levels. In the quench-annealed condition in which they were drawn, the carbon was in solution and, therefore, the brittle nature of the alloys could not be attributed to grain-boundary carbides.

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In an effort to improve drawability, some of the intermediate carbon alloys were heat treated to form fine pearlite or spheroidized carbides in a ferritic matrix. Ferritic alloys usually have low work-hardening rates and it was thought that most of the drawing might be done in the ferritic condition. Then, by employing an austenitizing anneal prior to the final stages of drawing, a high-strength nonmagnetic wire might be obtained.

★ ★ ★

The desired ferritic structures were obtained in some of the alloys by isothermally transforming them at temperatures of 1000 to 1200 F. The time and temperature required to obtain complete transformation was determined for each alloy. Metallographic examination of the structures and the high magnetism values obtained indicated that they were essentially ferritic.

★ ★ ★

Drawing tests on the isothermally transformed alloys showed appreciable improvement over the results obtained in the austenitic condition. However, the improvement was not sufficient to make the alloys attractive. The maximum reduction in area that could be given any of the heat-treated alloys was 86 per cent, whereas 43 per cent was the maximum obtained in the austenitic condition.

TABLE 3. CARBON-CHROMIUM-MANGANESE-IRON ALLOYS DRAWN IN THE FERRITIC CONDITION.

Alloy No.	Composition, per cent C	Cr	Mn	Heat Treatment	Magne Gage	Knoop Hardness As Heat Treated	Knoop Hardness Drawn 50% Red. in Area	Maximum Reduction, %
85	0.8	10	3.0	48 hrs at 1200 F	156	296	324	64
82	0.8	10	1.5	24 hrs at 1275 F	137	258	325	63
83	0.8	6	4.5	48 hrs at 1100 F	148	336	354	64
76	0.5	10	4.5	48 hrs at 1100 F	147	343	384	86

★ ★ ★

Some of the alloys that were isothermally transformed and the results obtained with them are given in Table 3. From these data it may be seen that the alloys were quite hard in the heat-treated condition. However, the hardness did not increase appreciably as the result of cold drawing. In spite of this low work-hardening rate, the alloys lacked sufficient ductility to withstand the reduction in area desired.

Low-Carbon Chromium-Manganese-Iron Alloys

The phase relationships in the chromium-manganese-iron alloy system were studied by Köster[1], Burgess and Forgeng[2], and Legat[3]. While their data were somewhat at variance, they found that the amount of manganese required to give a fully austenitic alloy decreased with increasing chromium content, reaching a minimum of about 15 per cent at 10 to about 14 per cent chromium. At higher levels of chromium, the structure contained some magnetic delta ferrite regardless of the amount of manganese present. Less manganese than that required to produce a fully austenitic structure resulted in mixed austenite and martensite.

★ ★ ★

During this current study a number of low-carbon chromium-manganese-iron alloys were made, and it was from these alloys that a satisfactory substitute for "18-8" stainless was developed. Most of these alloys were made as six-pound induction-furnace melts. Armco ingot iron was used for the base and the usual commercial ferroalloys were used for making additions of chromium or manganese. When nitrogen was added, it was added as high-nitrogen ferrochromium. Melting was done under a slag containing 42 per cent lime, 50 per cent alumina, and 8 per cent magnesia. The melts were heated to about 3000 F and the slag was treated with sufficient granular aluminum to reduce the chromium and manganese oxides. The slag was then skimmed and the melt was poured into copper ingot molds.

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The ingots were heated to 2050 F and forged to ¾-inch-square bars which were reheated and rolled to ¼-inch-diameter rod. Except for a few alloys, shown in Table 4, the alloys forged and rolled satisfactorily. Two alloys, both of which contained 3.0 per cent copper, cracked badly during forging. Other similar alloys with as much copper as 2.3 per cent were processed without difficulty. Apparently, copper in amounts as high as 3.0 per cent formed a grain-boundary constituents which was molten at forging and rolling temperatures and, thus, produced hot shortness. Presence of this grain-

TABLE 4 ALLOYS WHICH CRACKED DURING FORGING

Alloy No.	Composition, per cent C	Cr	Mn	Si	Cu
104	0.05	10.0	16.0	0.3	3.0
105	0.05	10.0	14.0	0.3	3.0
119	0.05	7.0	17.8	1.0	1.6
120	0.10	---	15.6	0.9	2.1

(1) Arch. Eisenhüttenwessen, 7, 687-8 (1933-34).
(2) Metals Technology, April, 1938.
(3) Metallwirtschaft, Jan. 1940, Feb. 1940.

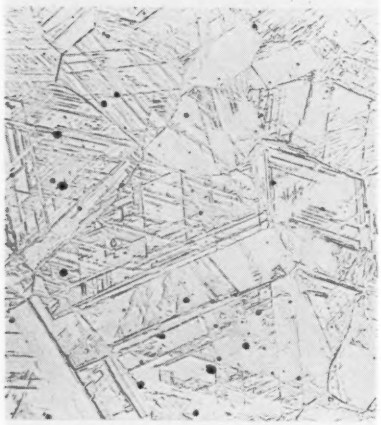
boundary phase was confirmed by metallographic examination. An alloy which contained 7.0 per cent chromium and one which contained no chromium also cracked during forging. These alloys contained 1.6 to 2.1 per cent copper, 15.6 to 17.8 per cent manganese, and 0.7 to 1.0 per cent silicon. It is possible that the combination of copper and silicon promote hot shortness where the chromium is low. Other alloys, which also contained no chromium, forged and rolled satisfactorily. These latter alloys had low silicon and, in one instance, contained 2.0 per cent copper.

★ ★ ★

The 1/4-inch-diameter rod was drawn in three dies to 0.135-inch diameter. It was then annealed at 1850 F, pickled, and drawn in six dies to 0.057-inch diameter. After reannealing and pickling it was drawn in twelve dies to 0.015-inch-diameter wire. Houghton's No. 3105 lubricant was used throughout the drawing operation. This is essentially the procedure used commercially for drawing chromium-nickel stainless steel.

★ ★ ★

Apparently, a copper addition of about 2 per cent improves drawability of these alloys. An alloy which contained 19.6 per cent manganese, 10.2 per cent chromium, and 0.04 per cent carbon could not be drawn to 0.015-inch-diameter wire by using the practice employed for the other alloys. Similar alloys, containing about 2 per cent copper, drew satisfactorily. The reason for this difference in drawability probably can be found in the microstructure. Figure 1 shows the annealed microstructure for the alloy just described which was difficult to draw. This microstructure is representative of alloys which contained no copper. Figure 2 is representative of similar alloys which contained about 2 per cent copper.



500x Picral etch 97034

Figure 1. Alloy 96 quenched from 2050 F.

500x Picral etch 97036

Figure 2. Alloy 99 quenched from 2050 F.

Because the alloy shown in Figure 1 was nonmagnetic, the structure probably is not martensitic. It is possible, though no X-ray proof was obtained, that this structure results from precipitation of epsilon carbide along crystallographic planes. This precipitated phase would be expected to decrease the ductility of the alloy.

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Alloys drawn to 0.015-inch-diameter wire, along with their tensile strengths and Magne Gage values, are listed in Table 5. Drawability of many of the alloys seemed equal or better than for "18-8" chromium-nickel stainless. They could be drawn 93 to 99 per cent between anneals, which compares favorably with "18-8" under similar drawing conditions.

★ ★ ★

To obtain an indication of the drawing force required and its relation to composition, the die pull at the 0.057-inch die was determined for a number of alloys. This was the last die before the second intermediate anneal, and, therefore, the wire was at its greatest tensile strength since annealing at

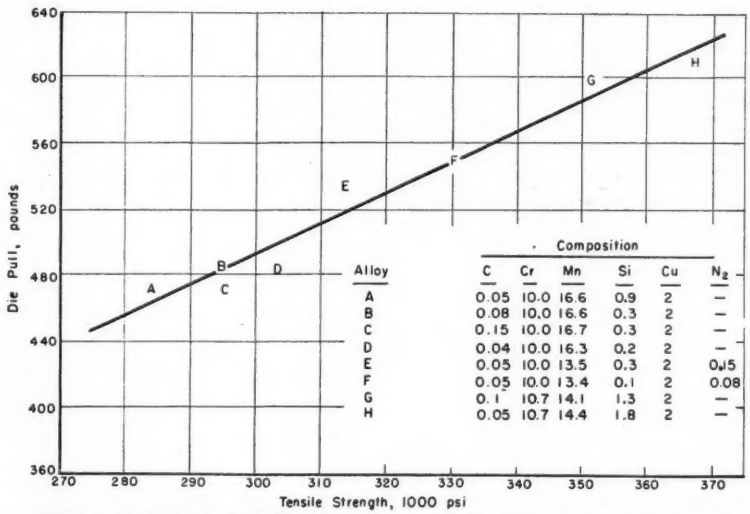
TABLE 5. COMPOSITIONS AND PROPERTIES OF 0.015-INCH-DIAMETER WIRE
(Composition in Per Cent)

Alloy	C	Cr	Mn	Si	Cu	N_2	Ni	T. S. psi	Magne Gage
111	0.08	10.4	13.3	0.8	2.0	--	--	334,000	58
114	0.05	10.7	13.4	0.1	2.1	0.08	--	330,000	22
115	0.05	10.0	13.5	0.3	2.0	0.15	--	316,000	16
112	0.10	10.7	14.1	1.3	2.0	--	--	351,000	8
92	0.08	13.0	14.3	0.4	--	--	--	320,000	45
122	0.04	8.8	14.3	0.9	2.0	0.10	--	292,000	18
113	0.05	10.7	14.4	1.8	2.0	--	--	367,000	24
103	0.05	10.0	14.5	0.3	2.0	--	--	293,400	42
93	0.06	12.9	16.2	0.3	--	--	--	340,000	8
102	0.04	10.0	16.3	0.2	2.0	--	--	303,000	14
123	0.15	11.5	16.3	1.3	2.3	0.14	--	301,000	13
107	0.05	10.0	16.4	0.5	2.0	--	--	291,000	7
109	0.08	10.0	16.6	0.3	2.0	--	--	294,000	1
106	0.05	10.0	16.6	0.9	2.0	--	--	284,000	3
108	0.15	10.0	16.7	0.3	2.0	--	--	295,000	0
99	0.05	10.1	18.4	0.2	2.3	--	--	276,000	0

0.135-inch diameter. A special die holder was made for the die-pull tests. Electric strain gages were mounted on the supporting member of the die holder and served to indicate the drawing force. A tungsten carbide die having a 12-degree taper was used. The wire was lubricated with Houghton's drawing lubricant No. 3105. Speed of drawing during the tests was 12.5 feet per minute.

★ ★ ★

Results of the die pull tests are summarized in Figure 3. In this figure the die pull is plotted against the tensile strength of the 0.015-inch-diameter wire.



Alloy	Composition C	Cr	Mn	Si	Cu	N_2
A	0.05	10.0	16.6	0.9	2	—
B	0.08	10.0	16.6	0.3	2	—
C	0.15	10.0	16.7	0.3	2	—
D	0.04	10.0	16.3	0.2	2	—
E	0.05	10.0	13.5	0.3	2	0.15
F	0.05	10.0	13.4	0.1	2	0.08
G	0.1	10.7	14.1	1.3	2	—
H	0.05	10.7	14.4	1.8	2	—

FIGURE 3. RELATIONSHIP BETWEEN DIE PULL AT THE 0.057-INCH-DIAMETER DIE AND THE TENSILE STRENGTH OF 0.015-INCH-DIAMETER WIRE A-6387

The die pull and tensile strength of the wire increased with decreasing manganese content. The effect of low manganese was partially offset by the higher carbon plus nitrogen contents of alloys E and F. The higher levels of silicon in alloys G and H apparently contributed to the high tensile strength and die pull of these alloys.

★ ★ ★

Reference to Table 5 shows that the tensile strength and magnetism decrease with increasing manganese content and with increasing carbon plus nitrogen. The desired tensile strength of about 300,000 psi and Magne Gage values of 10 or less probably can be obtained with manganese as low as 14.5 per cent. At this manganese level the carbon plus nitrogen content would need to be about 0.25 per cent. For a carbon plus nitrogen content of 0.1 per cent, about 16 per cent manganese would be required. It is probable that the carbon plus nitrogen should not exceed 0.25 per cent if undissolved carbides and nitrides are to be avoided. Undissolved carbides were observed in the microstructure of Alloy 123, which contained 0.29 per cent of carbon plus nitrogen.

★ ★ ★

It is evident from the data in Table 5 that chromium and silicon supplement each other. The optimum chromium content is about 10 per cent in combination with about 1 per cent of silicon. With less than about 11 per cent of chromium plus silicon, the alloys tend to be too magnetic unless the austenite-forming elements carbon, nitrogen, or manganese are increased. Also, with more than about 11.0 per cent chromium plus silicon, the alloys become more magnetic and the tensile strength increases beyond the 300,000 psi desired. Here too, the effect of higher chromium and silicon can be offset by increasing the carbon, nitrogen, and manganese.

★ ★ ★

Except for Alloy No. 111 which had low manganese content and was highly magnetic, all the alloys drawn to 0.015-inch-diameter wire appeared to have adequate ductility. Bend tests were made by clamping the wire between two steel plates and then alternately bending it through 180 degrees until it fractured. The total number of degrees through which it could be bent before failure was taken as a measure of its ductility. Except for Alloy 111 the values ranged between 210 and 390 degrees. Similar tests on "18-8" taken from commercial cable ranged between 360 and 510 degrees. This lower ductility of the chromium-manganese-iron alloys would not be expected to interfere with operation of Spiral-four cable in any way if it does not cause trouble in the braiding operation. Results of bend tests on Type 430 wire of the same diameter and drawn to 268,000 psi tensile strength averaged 180 degrees. Thus, the bend ductility for the chromium-manganese-iron alloys is appreciably higher than for straight-chromium stainless of comparable tensile strength.

★ ★ ★

Several lengths of the chromium-manganese-iron wire were cooled to —94 F for 15 minutes to see if this low-temperature treatment would affect their magnetism or bend ductility. There was no measurable change in these properties as the result of low-temperature treatment.

★ ★ ★

Electrical conductivity of the chromium-manganese-iron alloys appeared to be satisfactory for the cable application. The highest value was 2.6 per cent of standard copper. Most of the values, however, were 1.9 to 2.4 per cent of standard copper. Conductivity of "18-8" taken from satisfactory cable ranged between 1.9 and 2.2 per cent of standard copper.

★ ★ ★

Little attention was given to corrosion resistance of the alloy, as corrosion resistance is of secondary importance in the cable application. However, with about 10 per cent of chromium present, it is expected that the alloy will have reasonably good corrosion resistance. In scale-loss tests in air, which were made to determine the amount of scaling to be expected in open annealing, the chromium-manganese-iron alloys showed ap-

preciably less scaling than Type 302 stainless. However, the chromium-manganese-iron alloys tended to be rougher and more pitted than the chromium-nickel stainless after annealing. Where bright annealing is used, pitting would not be a problem. Percentage scale losses on .057-inch-diameter wire from Alloy 106 and Type 302 stainless for annealing periods of 10 and 20 minutes were as follows:

	Annealing Temperature and Time					
	1700 F		1800 F		1900 F	
Alloy	10 min	20 min	10 min	20 min	10 min	20 min
106	1.6	2.8	1.8	3.3	1.9	4.6
Type 302	3.9	6.2	4.7	9.8	5.8	10.8

★ ★ ★

To see how the chromium-manganese-iron alloys would draw under commercial conditions, a 225-pound induction furnace melt, Alloy No. 124, was prepared. The analysis obtained was as follows:

C	Cr	Mn	Si	Cu	N_2
0.10	10.7	16.0	0.9	2.0	0.15

★ ★ ★

The ingot was forged to 3-inch-square billets, then shipped to a commercial fine-wire mill for hot-rolling and drawing into 0.015-inch-diameter wire. Processing was carried out without difficulty, using the mill's standard procedure for Type 302 or Type 304 stainless steel. The drawing procedure was a little different than had been used in the laboratory, in that it was annealed at 0.110- and 0.051-inch diameter. Previously, anneals had been used at 0.135 and 0.057-inch diameter.

★ ★ ★

Tensile strengths of the wire after various stages of reduction are shown in Figure 4. The annealed wire had a tensile strength of about 100,000 psi, which increased to about 300,000 psi with 93 per cent reduction in area. This is similar to the work-hardening rate of Type 304 stainless steel. Properties of the finished wire were as follows:

Tensile strength, 292,500 psi

Tensile yield strength, 0.2 per cent, offset, 282,000 psi

Ductility (alternate bend test) 315 degrees

Electrical conductivity (per cent of standard copper) 2.2

Magnetism (Magne Gage value) 0

Spiral-four cable has been made from a five-pound lot of wire drawn from Alloy 93. This alloy contained 0.06 per cent carbon, 12.9 per cent chromium, 16.2 per cent manganese, and 0.3 per cent silicon. Its Magne Gage value was 6 to 8. Electrical properties of the cable were entirely satisfactory.

Conclusion

From the results of this study, it can be concluded that a satisfactory nickel-free wire for Spiral-four cable has been found. The wire has strength, electrical and magnetic properties similar to those of Type 304 stainless steel. While the total amount of alloys used is about the same as for Type 304 stainless, cheaper and more readily available manganese and copper have been substituted for about 8 per cent of the chromium and 9 per cent of nickel normally used in the chromium-nickel stainless.

★ ★ ★

While some further development work is desirable, it is evident that satisfactory results can be expected from alloys within the following percentage ranges:

C	Cr	Mn	Si	Cu	N_2
.08/.15	9.0/11.0	14.5/18.5	0.3/1.3	1.8/2.2	0.08/15

In the interest of conserving manganese, it is desirable to keep the manganese near the low side of the range given.

★ ★ ★

While this alloy was developed for a specific application, it should be useful anywhere that moderate corrosion resistance coupled with good workability or low magnetic permeability is required.

Acknowledgment

The authors are grateful to Signal Engineering Laboratories, Fort Monmouth, N. J. for supporting this work financially and for permission to publish the results.

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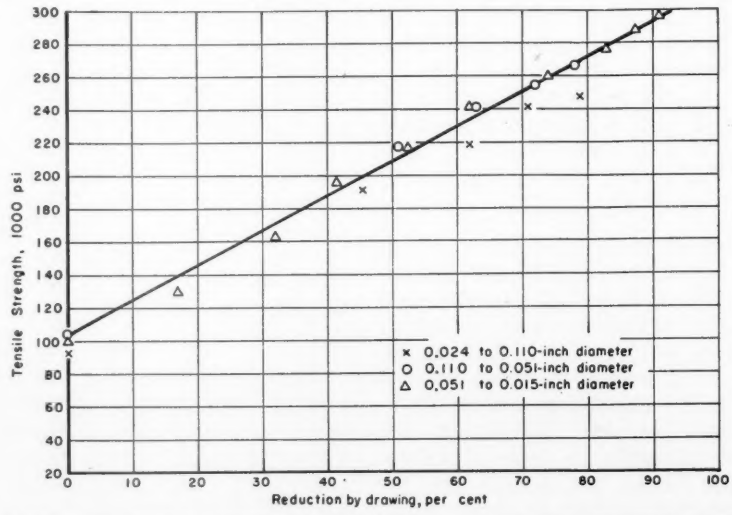
Tensile Strength, 1000 psi
Reduction by drawing, per cent
× 0.024 to 0.110-inch diameter
○ 0.110 to 0.051-inch diameter
△ 0.051 to 0.015-inch diameter

FIGURE 4. RELATIONSHIP BETWEEN TENSILE STRENGTH AND PER CENT REDUCTION IN AREA FOR ALLOY NO. 124 A-6388

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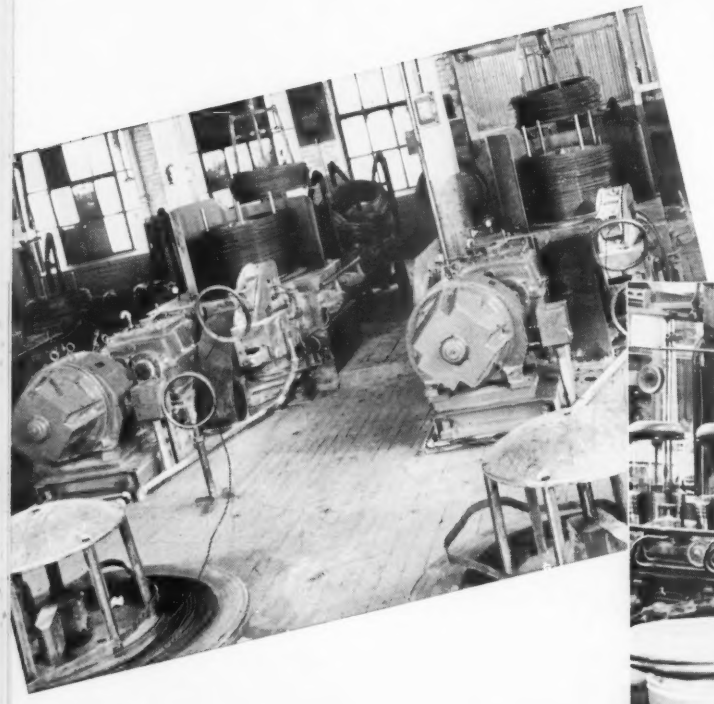

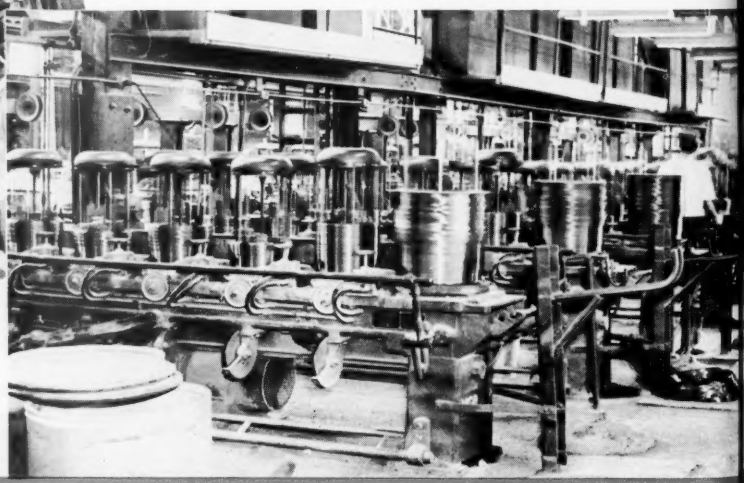

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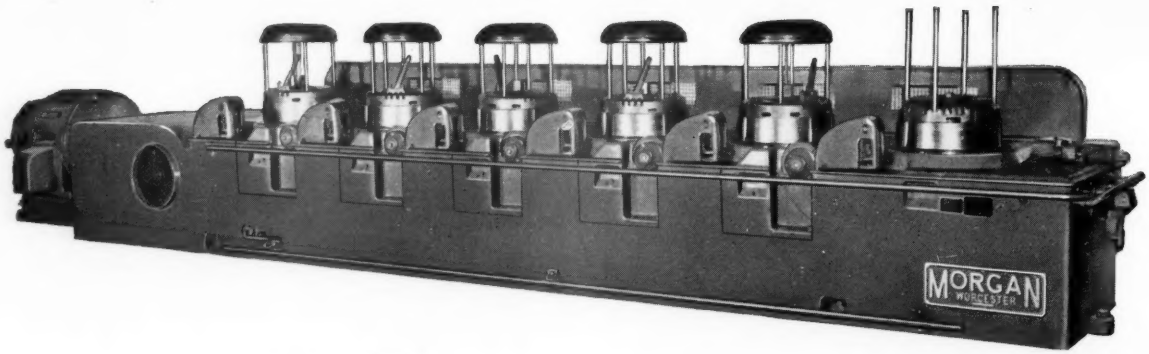

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All papers presented at the Convention by members of The Wire Association are eligible for consideration for the Annual Medal Award, and will be voted upon by the Board of Directors at the next Spring meeting of that body.

NON-FERROUS DIVISION

CHAIRMAN

William L. Wells
Sales Engineer
Reilly-Whiteman-Walton Co.
Conshohocken, Penna.

COMMITTEE MEMBERS

James E. Flood, Chief Chemist
Plastic Wire and Cable Corp.
Jewett City, Conn.

Sidney Rolle, Asst. Manager
The Scomet Company
New York, N. Y.

Leslie C. Whitney, Chief Met.
Copperweld Steel Corp.
Glassport, Penna.

Grayson B. Wood, Jr., Metallurgist
Scovill Manufacturing Co.
Waterbury, Conn.

All wire mill men and wire mill suppliers are invited to attend this convention, see how the Association functions and participate in the activities.

Hotel reservations should be made by members of the Wire Association direct to the Secretary.
MAKE YOUR PLANS NOW TO ATTEND AND SEND YOUR RESERVATION PROMPTLY

MONDAY, NOVEMBER 9th

9:00 A. M.	10:30 A. M.	12:30 P. M.
REGISTRATION	DIRECTORS' MEETING	PROGRAM COMMITTEE LUNCHEON

THE CONVENTION PROGRAM

LA SALLE HOTEL, CHICAGO, ILL., NOVEMBER 9-12, 1953

MONDAY, NOVEMBER 9th

9:00 A.M. Registration Desk opens on the mezzanine floor.

10:30 A.M. Annual Meeting of the Board of Directors of the Wire Association.

12:30 P.M. Directors' Luncheon for Program Participants.

AFTERNOON SESSION—2:00 P.M.

Joint Technical Meeting for Both Ferrous and Non-Ferrous Groups.

CHAIRMAN OF MEETING

Bruce W. Siemon, Standard Industrial Compounds Co., Chicago, Ill.

Address of Welcome by Leonard C. Crewe, Jr., Pres., Maryland Fine & Specialty Wire Co., Cockeysville, Md., President of The Wire Association.

PAPER: "Quality: the Key to Economical Use of Diamond Abrasives."	Only the customer controls the quality of the abrasives he buys. How to do this and its importance from standpoint of quality.	by C. R. Myer, Manager, Abrasives Division Elgin National Watch Co. Elgin, Ill.
PAPER: "A Nickel-Free Austenitic Steel for High Strength Wire."	A new non-magnetic manganese steel to replace stainless steel in spiral-four cable and elsewhere developed by the Institute.	by H. O. McIntire, Asst. Chf., Met. Eng. Div., and G. K. Manning, Chf., Met. Eng. Div. Battelle Memorial Institute Columbus, Ohio
PAPER: "Components of Wire Drawing Lubricants."	Properties of fats, fatty acids, soaps and additives. How understanding of these aids in producing lubricants with characteristics suited to drawing conditions.	by Leon Salz, Mgr., Lubricants Div. Magnus Chemical Company Garwood, N. J.

TUESDAY, NOVEMBER 10th

FERROUS SECTION

MORNING SESSIONS—9:30 A.M.

CHAIRMAN OF MEETING

Edgar T. Miller, Mgr. Wire Die Sales, Firth-Sterling, Inc.
Pittsburgh, Pa.

SYMPOSIUM: The Progress of Mechanical Descaling of Rods for Wire Drawing.

In these presentations various problems and factors connected with the process will be discussed. Each panel member will discuss a phase of the problems.

PANEL MEMBERS

George Fecson, Die Room Foreman
Pittsburgh Steel Co.
Monessen, Pa.

H. J. Godfrey, Asst. Chief Engineer
Development and Research
John A. Roebling's Sons Corp., Trenton, N. J.

C. F. Wickwire, Vice Pres.
Wickwire Brothers, Inc.
Cortland, N. Y.

Arthur Hedman, Die Room Foreman
Wickwire Spencer Steel Div.
Colorado Fuel & Iron Corp.
Palmer, Mass.

Walter A. Smigel, General Mgr.
R. H. Miller Company
Homer, N. Y.

Allyn E. Harper, Chf. Eng.
Oliver Iron & Steel Co.
Pittsburgh, Pa.

S. L. Stalson, Research Project Eng.
American Steel & Wire Div.
United States Steel Corp.
Cleveland, Ohio

NON-FERROUS SECTION

CHAIRMAN OF MEETING

Grayson B. Wood, Jr., Met. Scovill Manufacturing Co.
Waterbury, Conn.

PAPER: "Manufacture of Rivets and Screws."	Discussion of production techniques in producing ferrous and non-ferrous screws and tubular rivets.	by Victor Caltham Milford Rivet & Machine Co. Milford, Conn.
PAPER: "Processing of Phosphor Bronze Wire."	The common bronze alloys, their properties and manufacture of wire from raw materials.	by Earle W. Lovering, Asst. Wks. Mgr. Seymour Mfg. Co. Seymour, Conn.
PAPER: "Twisted Paper's Role in the Wire Industry."	Uses and properties of paper in electric conductor and wire rope constructions.	by W. Garwood Bacon, Jr., Sales Mgr. E. W. Twitchell, Inc. Philadelphia, Pa.

TUESDAY, NOVEMBER 10th (cont'd)

AFTERNOON SESSION—2:00 P.M.

FERROUS SECTION

CHAIRMAN OF MEETING

Ray S. Worth, Mfg. Mgr., John A. Roebling's Sons Corp., Trenton, N. J.

PAPER: "The Drawing of Shaped Steel Wire."	Methods of processing shaped steel wire with discussion of dies, coatings, lubricants and drawing machines.	by Vito J. Vitelli, Process Eng. Steel Wire Mill Div. John A. Roebling's Sons Corp. Trenton, N. J.
PAPER: "Continuous Annealing with Carbon Restoration of Coils and Bars."	Republic Steel's methods of controlling this phase of steel coil and bar manufacture.	by J. D. Armour, Chf. Met. Union Drawn Steel Div. Republic Steel Corp. Massillon, Ohio
PAPER: "Rod and Wire Quality vs. Cold Heading Quality."	The author does not take issue with the quality of the rods supplied by the producer, but rather with the improper uses to which they may be put in cold heading operations.	by W. E. Hill, Jr., Plant Supt. Russell, Burdsall & Ward Bolt and Nut Co. Rock Falls, Ill.

NON-FERROUS SECTION

CHAIRMAN OF MEETING

James E. Flood, Chief Chem., Plastic Wire & Cable Corp., Jewett City, Conn.

PAPER: "Rural Distribution Wire."	Characteristics, construction and installation of a new self-supporting six-pair wire developed as a rural distribution facility.	by C. C. Lawson, Wire Develop. Eng. Bell Telephone Laboratories Murray Hill, N. J.
PAPER: "A Review of Fluorothene in the Wire and Cable Industry."	Properties of fluorothene insulated wire, extrusion techniques in covering wire and the latest testing methods, particularly for high temperature performance.	by F. W. Wurtzell and W. J. Canavan, Dev. Engrs. Bakelite Company New York, N. Y.
PAPER: "Neoprene Coverings for Weatherproof Wire."	Discussion of properties important in a covering for weatherproof wire and neoprene's use in this respect.	by C. E. McCormack and R. H. Baker Rubber Chemicals Div. E. I. duPont de Nemours & Co. Wilmington, Del.

WEDNESDAY, NOVEMBER 11th

MORNING SESSIONS—9:30 A.M.

FERROUS SECTION

CHAIRMAN OF MEETING

C. H. Williams, Supt. Wire Mills, Pittsburgh Steel Co., Monesson, Pa.

PAPER: "Handling and Storing of Wire and Wire Products."	Effect of change of rod bundle size on storage space and revisions required to handle and store wire products for efficiency.	by C. C. Tappero, Supt. Wire Mills Colorado Fuel & Iron Corp. Pueblo, Colo.
PAPER: "The Foreman's Function with Regard to Methods of Controlling Quality."	Basic theory of quality control program with applications to oil tempering and patenting departments.	by M. G. Boyd, Asst. West Mill Supt. Steel Company of Canada, Ltd. Hamilton, Ont., Can.
PAPER: "Production and Quality Control, Plus Mill Information—Sales Department Musts."	Relationship of production and sales departments necessary to keep both functioning at full efficiency for customers.	by Eugene K. Wright, Sales Mgr. Manufacturers' Division Continental Steel Corp. Kokomo, Ind.

NON-FERROUS SECTION

CHAIRMAN OF MEETING

Leslie C. Whitney, Chf. Met., Copperweld Steel Co., Glassport, Pa.

PAPER: "Results of Research on Insulated Wire."	Discussion of microbiological deterioration of and improvements made in last decade in rubber insulation.	by Dr. John T. Blake, Dir. of Research Simplex Insulated Wire & Cable Co. Cambridge, Mass.
PAPER: "Electrical Motors and Control for Slip Type Wire Drawing Machines."	This paper is concerned with such equipment as it applies to non-ferrous wire drawing machines.	by H. A. Dickerson, Application and Project Engineer Control Engineering Dept. Westinghouse Electric Corp. Buffalo, New York
PAPER: "The Properzi Process for Continuous Casting and Rolling of Aluminum Redraw Rod."	Since this process of casting rod was introduced to this country, significant improvements have been effected in it. How the process is used here and in Europe is described.	by Frank R. Nichols, Pres. Nichols Wire & Aluminum Co. Davenport, Iowa

WEDNESDAY, NOVEMBER 11th (cont'd)

AT 1:00 P.M. — THE ANNUAL WIRE ASSOCIATION LUNCHEON

GUEST SPEAKER: L. B. Worthington, Pres. U. S. Steel Supply Division
U. S. Steel Corporation, Chicago, Ill.

LADIES WELCOME — LADIES WELCOME

The Mordica Memorial Lecture: "Reminiscings of an Old-Timer."
by Charles D. Johnson, Former President, Johnson Steel & Wire Co., Worcester, Mass.

THE PRESENTATION OF AWARDS FOR 1952

MEDAL AWARD: Howard J. Godfrey, Asst. Chief Eng., Development Engineering, John A. Roebling's Sons Corp., Trenton, N. J. for the most meritorious paper—"Significance of the Elongation Test on Wire."

CERTIFICATE OF HONORABLE MENTION for Ferrous Papers: Jere Y. Heisler, Asst. Genl. Foreman, Wire Drawing, Rod and Wire Mills, Bethlehem Steel Co., Sparrows Point, Md., for paper—"Improved Lime Bath Performance by Recirculation."

CERTIFICATE OF HONORABLE MENTION for Non-Ferrous Papers: Edward P. Hall, Met., Kennicott Wire & Cable Co., Phillipsdale, R. I., and Robert D. Peck, Dist. Eng., Industrial Products Div., Johns-Manville Sales Corp., Boston, Mass. co-authors for paper —"Development of New Asbestos Insulated Magnet Wires."

AT 4:00 P.M.—THE ANNUAL MEETING OF THE WIRE ASSOCIATION
This is the annual business meeting of members of the Association. Your personal attendance is needed and urged.

Chairman of Meeting
Leonard C. Crewe, Jr., President,
The Wire Association

IN THE EVENING

THE ANNUAL STAG SMOKER—DINNER

6:30 P.M.—Cocktail Bar Opens

7:30 P:M.—Dinner and Show

CHAIRMAN, ENTERTAINMENT COMMITTEE: Eber J. Hubbard, Jr.

COME ONE, COME ALL—AND HAVE A GOOD TIME!

THURSDAY, NOVEMBER 12th

The day is devoted entirely to plant inspection tours, of which there are two, as follows:

FOR THE FERROUS GROUP: To Republic Steel Corporation's Rod and Wire Mills in Chicago. Busses leave the LaSalle Hotel early Thursday A.M.

FOR THE NON-FERROUS GROUP: To Western Electric Company's Hawthorne Works. As no more than 125 men can be handled on one trip, TWO TOURS ARE PLANNED. The first must leave the hotel in busses at 8:30 A.M. and be out of the plant by 11:00 A.M. The second will leave the hotel at 1:30 P.M. and leave the plant by 4:00 P.M. Go on the first trip, if possible.

PERSONS WHO ARE NOT U. S. CITIZENS MUST BE CLEARED IN ADVANCE FOR ALL TOURS. PLEASE ADVISE MR. BROWN BY NOVEMBER 1st OF YOUR DESIRE TO TAKE THIS TRIP.

FOR BOTH TOURS, FERROUS AND NON-FERROUS, ALL PERSONS MUST GO BY BUS. NO PRIVATE CARS MAY BE USED. TO BE ADMITTED, ALL VISITORS MUST WEAR THEIR BADGES; NO EXCEPTIONS, PLEASE: THESE MEASURES ARE FOR SECURITY REASONS.

These plant inspection trips conclude the 1953 Convention.

RESEARCH PAPERS ARE PREPRINTED IN THE OCTOBER ISSUE OF WIRE AND WIRE PRODUCTS.

The Discussions and the Mordica Memorial Lecture will be printed in the January issue of Wire and Wire Products.

Papers not received in time for preprinting will be published in the November and December issues of Wire and Wire Products.

The Foreman's Function Regarding Methods Of Controlling Quality

by M. G. Boyd
Assistant West Mill Superintendent
Canada Works
The Steel Company of Canada, Limited
Hamilton, Canada

Quality Control means being able to produce goods to set standards and within acceptable limits specified by the customer. Variation exists in the most precise manufacturing operation known and no matter how we strive for exact duplication, we never quite obtain it. If we can control variation within required limits the customer is satisfied and we have taken a major step in establishing a prosperous business.

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In this paper we are going to discuss some facts that have been learned from Statistical Quality Control techniques, and develop them into a few routines whereby the foreman can keep his quality problems in an elementary state. In eliminating or controlling quality problems with these routines we also provide the basis for controlling flow of materials, establish a constant work load, reduce scrap losses and handling costs, increase the yield, reduce accident ratio and establish a minimum of absenteeism and labor turnover. These benefits cannot be ignored.

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Statistics have proven time and again that if a foreman is having trouble with quality, it is due to one or more of these assignable causes:

1. **Human Element**
2. **Faulty Maintenance of Equipment**
3. **Operator Maladjustments**
4. **Producing changes—Speed—Temperature**
5. **Raw material imperfections**
6. **Methods**
7. **Inspection**

Mr. Boyd started with the Steel Company of Canada Limited in 1939 in Industrial Engineering. He served in the R.C.N. from 1941 to 1946. Returning to the Steel Company of Canada after the war, he was transferred to Industrial Engineering, Cold Finishing Mills. Commenced in the Production Departments in 1948 as Supervisor in Cold Heading, Heat Treating and Galvanizing and later was General Foreman. Appointed to present position of Assistant Superintendent in 1950.

This paper was prepared for presentation before the Annual Convention of The Wire Association on November 11, 1953 in Chicago, Ill.

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From the foregoing list, we see that the quality of any article depends on equipment, methods and inspection. It is influenced by the materials used, supervision, instruction, worker's skill and alertness and by the human element. In our experience we have found that quality failures can be traced to the human element more often than to any other cause.

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Before we outline any procedure that the foreman could use in controlling quality, we should define what is meant by the term "Human Element" in relation to Quality Control.

M. G. Boyd ★ ★ ★ ★ ★

Human Element

We are not going to get involved in psychology but we are going to discuss some of the elements of human nature that do affect quality and at times can be most exasperating to a supervisor.

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Every object has different qualities. Steel is different from wood and water is different from oil. We do not expect wood to do the things that steel will do and we are not disappointed about this fact. We would not try to replace water with oil. In accepting these facts, we are admitting that we know the exact limitations of the steel, wood, water and oil. We learn the exact limitations of materials and equipment and we take care not to exceed them.

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People also have their differences or peculiarities just like the steel and wood. We are interested in the peculiarities of people that must be controlled if quality is to be maintained.

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One of the most important inadequacies people have is the inability to understand peculiarities in their associates. We are not as reasonable about people and their failings as we are about the limiting factors of the steel and wood. The foreman must spend time in

analyzing his men and determining just why they act the way they do.

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There are 5 human peculiarities that must be controlled if quality is to be maintained.

1. No One is Perfect

No one is perfect in all respects. Everybody has peculiarities pronounced to the point of being handicaps. The foreman must remember that if the nature of the job is such that the handicaps of the new employee are constantly brought to the surface, there is no point in keeping him. Handicaps that will seriously affect quality are:

a. **Those who are physically incapable of performing the job duties.**
b. **Failure to grasp and apply job training.**
c. **Those who are not emotionally stable.**

2. We Are Not Always Sensible

Many people show a definite inability to plan and therefore they are not always sensible. Many of us are gifted with hindsight rather than foresight. Some of us when working on a job will have total disregard for quality standards because they interfere with what we are doing at the moment. When working on piece work we are so wrapped up in pounds per hour that we forget all about those little things that make a reject instead of a product of high quality. Speed without proper adjustments to equipment or without taking the proper steps to control quality will produce rejects.

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When investigating complaints and tracking down production losses, we sometimes get these excuses from the men:

"I forgot about it" or "I didn't have time."

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It is definitely human nature to be in a hurry and to be forgetful. In other words, we don't always act sensibly.

3. People Would Much Rather Follow Than Lead

The majority of people do not have the ability to examine all aspects of a situation. They are, for the most part, poor analysts. That is why people would rather follow than lead. They must be assured that what they are doing is right and that they are aimed in the right direction. The tendency to follow rather than lead is an important trait for while it is an exasperating one at times, it can be very useful in establishing quality control routines.

4. People Require a Standard To Live Up To

All the way through life people require a standard to live up to. No one person remains unto himself. Each one of us is part of the gang or crew.

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Everybody has some idea of what is the right or the wrong way to act in the department. Ideas may be very vague or only half formed but they are there. If the foreman will take advantage of this peculiarity and establish himself as the leader and set the standards for people to live up to, he will have taken a major step in controlling quality.

5. People Forget as Easily As They Remember

Statistically there is a 50-50 chance that you will remember. The odds can be influenced by people who develop a memory but conversely the higher a man rises in an organization the more problems he will have to think about and the odds have a tendency to level out.

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There is one obvious method of handling this problem and that is to carry a notebook and jot it down. This will leave your mind free to think about the solution rather than the problem. It also allows you to get organized and solve the problems with the most important item receiving attention first.

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This sums up the more important peculiarities that will affect quality and defines what is meant when we refer to the "human element" in relation to quality control.

Procedures Developed

About 4 years ago we considered our method of operation and decided that there must be a better way of controlling quality and output than we were using at the time. We wanted to get those peculiarities of the human element to mesh with the mechanical items that can cause rejects.

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It was our belief that routines based on statistical know-how could be used to control quality instead of statistics on the job to forecast when something was going to happen. We were convinced that if we took advantage of what the foreman knows and has taken years to learn, we could control quality without saddling him with mathematics.

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The Patenting and Tempering Department was the starting point. This is a conventional department using hardening and tempering units and patenting or strand normalizing on rods and wire.

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The following steps were carried out: A policy was set that no matter what procedure was established it was to be put in writing. This is important for these reasons:

a. **It establishes a policy and gives control over anyone who tries to operate with no policy.**
b. **It keeps all shifts working to the same policy and establishes uniformity.**
c. **It is the answer to the following problems of the human element:**
   1. **Inability to plan. Written routines take a lot of planning.**
   2. **It establishes what is the right or wrong way to act in the department and provides that standard that people require.**
   3. **It eliminates part of the forgetting that we all have a tendency to do.**
d. **It points to the foreman as the department leader.**

Operator Maladjustment

Job training was the first routine established and provides the basis for controlling operator maladjustments. This routine was established on the Patenting furnace

and consisted of an exact description of the furnace, reels and take-up equipment, their limitations and how they should be operated. For example:

a. **Reels must be in proper operating condition.**
b. **Separators should not be scratched or worn.**
c. **Air and gas valves should be in proper adjustment.**

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As each new employee starts in the department, the foreman explains to him what happens to the quality if one of these items gets out of line.

a. **Reels—If reels become worn we get breaks and this is serious where the customers specify exact weight coils. There is also the resultant loss in down time and efficiency. If the rods or wire get caught on the reels, they pull down in size in the furnace. If correct tension is not maintained, wires may be wavy or of poor cast.**
b. **Separators—If separators become worn, scratching results and the material can be rejected for faulty surface.**
c. **Air and Gas Valves—If air and gas valves are not kept in good operating condition and proper adjustment, blow back and burning in the spuds results. This eventually causes faulty operation of the furnace and improper heating, and temperature cannot be maintained under full load.**

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The foreman makes no attempt to cover the full job training plan with the new employee at their first training session. Only part of the plan is covered and a review is held the following day with the new employee explaining to the foreman how the job operates. This gives the foreman an opportunity to assess whether or not the new employee is absorbing instruction. During these training sessions the foreman is also able to decide whether or not the man is emotionally suitable for the job.

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He can determine if the man is careless or not. Every man has a pride of workmanship but in some it requires more work on the part of the foreman to cultivate it and bring it to the surface. Carelessness must be checked. If allowed to exist, it will spread through the department. If one man gets away with something, his fellow workers are bound to interpret this new level of quality as the acceptable minimum. They feel that their previous impression of what was wanted was incorrect.

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At some time during the training session, the foreman should be sure that the following points have been covered:

1. **Steady work is dependent on good quality because the customer doesn't buy from the Company unless he is sure that he will receive full value for money spent. The Company's reputation rides on every order that is shipped.**
2. **New men sometimes feel that the best way to impress the foreman is to turn out the work in quantity. It should be stressed that quality comes before quantity, otherwise the demand will fall and there will be little chance of quality or quantity being a problem in the future. It can be pointed out that speed comes from familiarity —the most important thing is to develop good operating habits before speed is increased.**

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If the foreman is operating from a written job training procedure, he has the opportunity at the end of one week of determining fairly accurately whether or not the man is suitable. He has a standard against which he can compare ability.

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In our discussion of the human elements there was the admission that no one is perfect. We defined suitability as:

1. **Being emotionally stable.**
2. **Able to grasp and apply job training.**
3. **Physically capable.**

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At the end of the first week, the foreman should be quite clear in his mind about items 1 and 2. He probably took care of physical capabilities when interviewing job applicants.

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It may not be possible to reach a final decision yet as to emotional suitability. In cases such as this there are a few policies that can be established to aid the foreman if he decides to hire some of the borderline cases:

1. **Working standards, when issued by Industrial Engineering, should have a statement on the bottom of the rate sheet: "Rejects will not be paid for".**
2. **Most jobs have a range of rates. The foreman should, when checking his job training plan, let the new man know where he is falling down. He should advise him that the next base rate increase rests on the correction of his inadequacies and then see that they are corrected before the next increase is given.**

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At this point the foreman has taken the precaution of controlling operator maladjustments and made a good effort toward controlling 4 of the 5 human elements that can cause quality troubles.

Faulty Maintenance of Equipment

Play in machinery whether due to loose connections, vibration or wear will cause considerable trouble for the foreman if allowed to go undetected.

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No one expects the men to turn out quality work unless the equipment is in proper operating condition. The foreman should have no tailor-made alibis ready for use by anyone in his department when a quality failure occurs. This condition places the foreman at a decided disadvantage and he has a weak case when discussing quality with his men.

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Controls for equipment are relatively simple. Once a week on shutting down equipment on the last shift, the foreman has a written questionnaire that is checked against each unit. This questionnaire covers all the points on equipment that could become worn and cause rejections on the next week's run. These are the same points that were discussed in the job training plan. For example:

1. **Reels should be in good repair and riding freely. There should be no welds or rims broken, etc. where wires can catch.**
2. **Separators at entrance of furnace should not be worn to the point that scratching will result.**
3. **Burners should not be plugged or dirty and thus operate inefficiently.**
4. **Thermocouple is to be replaced once a month.**
5. **Is lead level at correct height in quenching pan, etc.?**

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On completing his analysis, the foreman makes out work orders for

HUBBARD SPO

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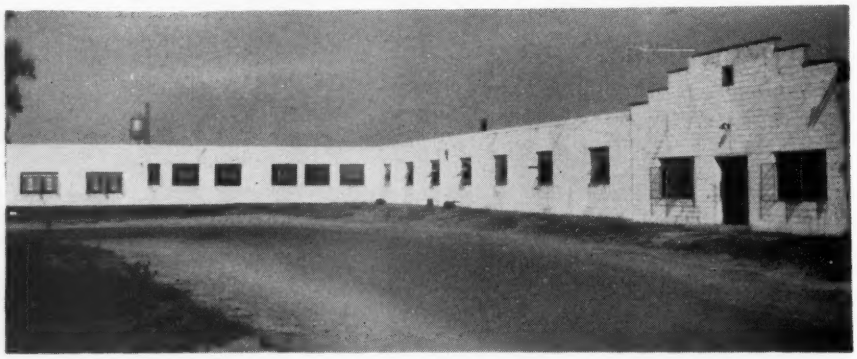
THE COMPANY

Why HUBBARD Leads in the Manufacture of REELS and SPOOLS



View of home of Hubbard spools and reels. It is being further expanded at the present time.

- New modern fireproof building—70,000 sq. ft.
- Located on main East-West line of B. & O.
- Three additional railroads, truck and plane service to all parts of country.
- Central geographical location—18 miles north of Ft. Wayne, Indiana.
- In addition to the value of our machinery and building, an investment of three quarters of a million dollars in tools and dies enables us to render the only fully comprehensive reel and spool service.
- Business kept abreast of the expansion and new developments of the wire industry.
- Over 40 years experience.

WE EXTEND TO YOU A CORDIAL INVITATION TO

OOL COMPANY

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THE PRODUCTS

A Complete Line from One Source

REELS and SPOOLS for

DRAWING and PROCESSING:

(1) Steel spools and reels — welded and brazed.
(2) Fabricated aluminum spools.
(3) Cast aluminum and magnesium spools and reels.
(4) Metal bound plywood flange, steel or special segment hub, Patented arbor—for drawing and shipping.

SHIPPING—RETURNABLE:

(1) Wood-Metal spools.
(2) Aluminum spools.
(3) Cast spools and reels—Aluminum and Magnesium.
(4) Metal bound reels—all types—nailed, plywood, dimension lumber flanges. Stave, steel, or segment drums.
(5) Steel spools and reels.

SHIPPING—NON-RETURNABLE:

(1) Wood spools.
(2) Plywood head reels.
(3) Pressed board spools.

DRUMS (TRAVERSES):

(1) Flanged steel—galvanized, painted, plain.
(2) Sectional steel.
(3) Reinforced—flanged.
(4) Wood segment.

SPECIAL TYPES:

Wood.
Steel.
Cast.
Reels with special fittings.

ACCESSORIES:

(1) Flanges.
(2) Drums (traverses).
(3) Reel hardware—arbor plates—washers.
(4) Special lagging.

All HUBBARD Spools and Reels Represent the Finest in Quality and Workmanship for their end uses.

ON TO VISIT OUR SUITE DURING THE CONVENTION

the Maintenance Department and forwards them for immediate attention.

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If carried out each week, this routine will insure equipment being in top operating condition and functioning correctly.

Follow Up

The last procedure we established was a daily routine. A procedure that has been set-up soon perishes and dies if left to exist by itself. This means that the foreman must provide the interest and drive to keep it alive. This is actually his most difficult task for it requires observation, diplomacy and persistency if it is to be done correctly.

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The amount of following up which the men require will depend largely on the individuals and the nature of the work. Since we have all types and varying conditions, it actually requires a check each shift.

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The foreman has established a standard for his men to work to in his job training plan; now he must be sure that the plan is being carried out. At the start of each shift, the foreman should make a trip around the department and record all the items that will require his attention during the balance of the shift. As he goes, the job set-up and operating technique of each man is checked. If he notices that something is being done contrary to the standards set up in the job training plan, it is pointed out to the man on the job at this time and extra instruction given on this point. In addition, observations are made regarding material available and condition of material, housekeeping, scrap produced and general operating conditions. To do this quickly and successfully, the foreman must know his job training plan letter perfect or it will develop into a long routine each shift and this is not desirable.

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It is necessary for the foreman to adopt this practice as it is the only method developed to date whereby we can place any control over that one remaining human element, namely: "people do not always behave sensibly." This is the most difficult of the human elements to control.

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This procedure must be supported with some of the following organization:

1. **Check stock and schedules to be sure that material is correct and the type that the order calls for.**
2. **Be sure that production is identifiable to the operator who produced it.**
3. **Stock must be identified with proper heat tags.**
4. **Tolerances on any order should not exceed the high or low limits.**

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The foreman, as he goes through his department, must determine the assignable cause for any variation beyond the normal tolerances allowed. For example, if the physical tests of wire running on a patenting furnace show any unreasonable variation, it could be one or more of these reasons:

1. **Heats of furnace zones are not correct.**
2. **Speeds are not correct.**
3. **Thermocouple may be broken.**
4. **Wires may be cabled.**
5. **Test machine may be out of adjustment.**
6. **Mixed heats or material.**
7. **Furnace may not be evenly heated throughout and have cold spots in it.**
8. **Raw material imperfections.**
9. **Tester may have made a mechanical error in his calculations.**
10. **Heavy scale on bottom of the furnace.**

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The exact cause must always be determined and eliminated at the time it is noticed, not on the next shift, or the day shift, or the week after; but immediately.

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This policy of shift checking and immediate determination and correction of assignable causes will keep the system alive and functioning correctly.

Processing Changes

Temperature changes will cause considerable trouble if not controlled rigidly. The equipment manufacturer has solved most of the problems of human failures and it is largely a matter of keeping the instrument in proper operating condition. There are some operating policies that the foreman can institute so that control of heating cycles can be maintained.

1. **In conjunction with the Mechanical Department, set up a regular period for instrument maintenance and have a system of signing for the service when rendered.**
2. **The foreman should cycle the instrument at the start of each shift to insure proper function.**
3. **Take an optical reading of the wire at the exit end of the furnace.**

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The furnace man or operator on each shift would carry out these details:

1. **Initial the chart a minimum of 4 times through the shift and state the time.**
2. **Mark material sizes and grade changes on the chart as they occur on the schedules.**
3. **Mark speed of take-up blocks on chart.**
4. **If any inconsistencies occur on the recorder, they must be explained in writing on the chart.**

These routines should establish control over heating cycles.

Raw Material Imperfections, Methods and Inspection

If the foreman follows the policy of determination of assignable causes, he will automatically track down and eliminate any problems arising from faulty materials, methods and inspection.

Maintenence of Routines

Before closing, we should consider one point. When rejections are reduced, output good and the cost picture favorable, the foreman has a tendency to slacken off and that is when trouble can be expected. Control of quality is a problem that is never completely solved because there are two factors that clash continually:

1. **High output per hour and demand for products are greatest when quality is standardized.**
2. **No two articles are exactly standard. Quality varies continually. We know from statistics that quality of any mass manufactured item when measured from unit to unit or from lot to lot will show variation.**

(*Please turn to page* 1146)

Processing of Phosphor Bronze Wire

by Earle W. Lovering
Assistant Works Manager
Seymour Manufacturing Company
Seymour, Connecticut

Phosphor bronzes, which are basically alloys of copper and tin, are among the oldest alloys known to man, having been used for 5000 years. Today phosphor bronze is being used in greater amounts than ever before because it combines the useful properties of strength and corrosion resistance at a moderate cost.

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Phosphor bronze wire is made in three principal tin contents, 5%, 8% and 10%, called Grades A, C and D respectively. All of these alloys are single phase, homogeneous alloys in the equilibrium condition and the higher tin content increases the strength. The alloys are readily cold worked, which is the only method of hardening them.

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A.S.T.M. Specification No. B 159, covering phosphor bronze wire, has the following composition limits:

	ALLOY A	ALLOY C	ALLOY D
Tin %	3.5-5.8	7.0-9.0	9.0-11.0
Phosphorus %	0.03-0.35	0.03-0.35	0.03-0.35
Iron—Max. %	0.10	0.10	0.10
Lead——Max. %	0.05	0.05	0.05
Zinc——Max. %	0.30	0.20	0.20
Copper & Tin % and Phosphorus—Min. %	99.5	99.5	99.5

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Phosphorus hardens the alloys and acts as a deoxidizer when the metal is liquid. For this reason, phosphor bronze welding rods are generally made with a phosphorus content of about 0.30% while phosphor bronze, for uses such as springs, not requiring welding, is made with a phosphorus content of about 0.10% to 0.20%.

This paper, prepared for presentation at the Annual Convention of The Wire Association in Chicago on November 10, 1953, treats of the common bronzes and their manufacture into wire from the raw materials. The author graduated from M. I. T. in 1938 with a B.S. in Metallurgy degree. From 1938 to 1946 he worked with Revere Copper and Brass, Inc., in New Bedford, Mass., Los Angeles, Calif., and Detroit, Mich. He joined Seymour in 1946, where he has been for the past seven years.

Iron is a hardener and inhibits the grain growth on annealing. Lead increases brittleness and can make the alloy hot short if present in sufficient quantity. In certain types of phosphor bronze, it is added deliberately to increase machinability but in alloys A, C, and D lead is a harmful impurity and is kept to a minimum.

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Physical properties of 5%, 8%, and 10% phosphor bronze wire are completely specified in A.S.T.M. Specification B-159, which gives tensile strength limits for various tempers of all three alloys. Figure 1 shows the work hardening curves (tensile strength versus percent reduction by drawing) for all three alloys. Here we can see the hardening and strengthening effect of increasing tin content.

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Grade A, 5% phosphor bronze is the alloy most used as wire and is commonly used in spring temper, although other tempers are occasionally supplied. The requirements for this alloy and temper are specified as follows by A.S.T.M. B-159.

Diameter, inches	Tensile Strength p.s.i., min.
.025 and under	145,000
Over .025 to .0625	135,000
Over .0625 to .125	130,000
Over .125 to .250	125,000
Over .250 to .375	120,000
Over .375 to .500	105,000

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All phosphor bronze alloys have excellent fatigue strength, in the order of 30,000 p.s.i. for 5% spring wire. In addition, the elastic limit and proportional limit are high in relation to the tensile strength.

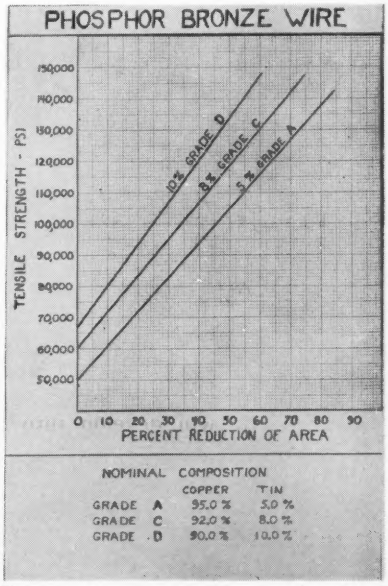

Figure 1.

Figure 2 shows a stress strain curve for 5% phosphor bronze spring wire. Note that the phosphor bronze in the elastic range has a linear relationship between stress and strain with 0.10% offset elastic limit of 128,000 p.s.i. and an elastic modulus of 15,000,000 p.s.i.

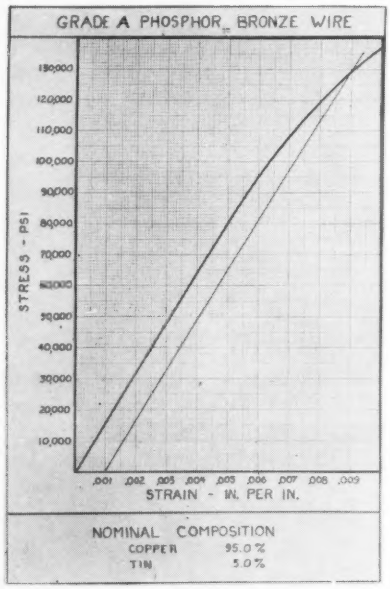

Figure 2.

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This is one of the principal advantages of phosphor bronze as a spring material because the high elastic limit allows high stresses before permanent set takes place and the true proportionality in the elastic range permits exact load deflection calculations based on a constant elastic modulus up to the yield strength.

The electrical conductivity of Grade A phosphor bronze is 16% I ACS, Grade C is 13%, and Grade D 11%. While these figures may seem low in relation to copper at 100% and cartridge brass at 28%, it must be remembered that phosphor bronzes are much stronger than these metals and, compared to metals of equal or superior strength and elastic properties, phosphor bronze has superior electrical conductivity. For instance, steel and nickel alloys suitable for springs have electrical conductivities of 5% or less.

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The corrosion resistance of phosphor bronze to most substances is excellent, being about the same as that of copper. The resistance to wear and abrasion is exceptionally good and phosphor bronzes are used in great quantities as bearings.

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We have seen how the phosphor bronzes combine high tensile and fatigue strength and excellent elastic properties with good electrical conductivity, excellent corrosion resistance, and excellent abrasion resistance. It is obvious that this material is ideal for springs. Grade A, 5% phosphor bronze is the alloy principally used, accounting for about 95% of the phosphor bronze spring wire sold, with Grades C and D being the other 5%.

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8% phosphor bronze is used extensively for fourdrinier screens, the heart of the paper making process. The fourdrinier is an endless wire-cloth belt running over suction boxes, which drain the excess moisture from the treated pulp. Phosphor bronze wire is used because it has the necessary corrosion resistance to the solutions, abrasion resistance to the scraping of the suction boxes, and elasticity to permit continual bending around the rollers. Wire for fourdriniers must be drawn to fine sizes (less than .010″ dia.) and must be readily welded because the fourdrinier cloth is made into an endless belt by welding the ends of the warp wires together. No other material has yet been found to combine all these properties so well as phosphor bronze.

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The processing of wire which we will describe here is that used at The Seymour Manufacturing Company but it is essentially the same as that used by the other large producers of phosphor bronze wire in this country.

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The metal is first cast in rods about 2″ in diameter and about 8 ft. long, pointed at one end for easy sticking during rolling. These rods are machined to remove the rough cast surface, sub-surface porosity from mold dressing, and inverse segregation typical of phosphor bronzes. The alloys are then annealed at 1250° F. for five hours to homogenize them and transform the dendritic structure of the casting into an equiaxed grain structure more suitable for rolling.

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Figure 3 shows the micro-

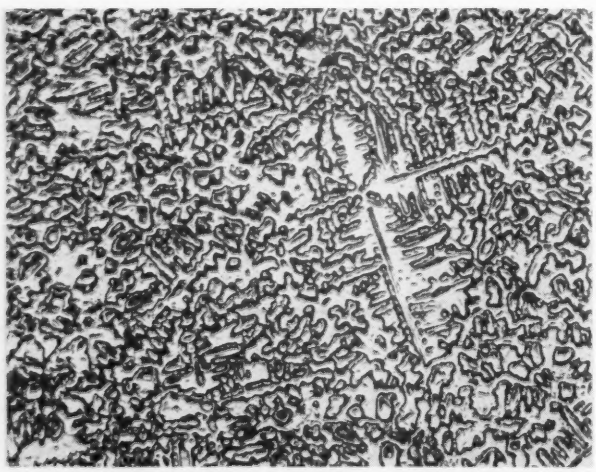

Figure 3.

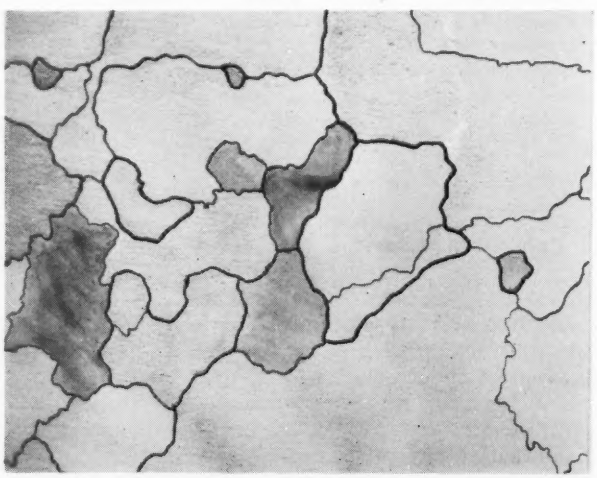

Figure 4.

structure of a casting before the homogenizing anneal. The cast structure consists of α solid solution with an interdendritic filling of $\alpha + \delta$. After homogenizing, this structure has been completely changed to a uniform α solution of equiaxed grains, shown in Figure 4. This is a vital operation because the δ phase is an intermetallic compound having a composition of Cu 31, Sn 8. Like all intermetallic compounds it is very hard and unless it is completely dissolved by a homogenizing anneal, the rods will invariably crack on rolling or break in a further drawing operation.

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The rods are now rolled in oval grooves and annealed. They are then reduced to 11/32″ by a series of rollings and anneals.

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Rolling to 11/32″ is done in a 12 stand Tandem mill. This piece of equipment consists of 12 rolling mills with Vee groove rolls with the axis of each set of rolls at 90° to the axis of the preceding set. The rolls are geared to the main drive shaft so that each roll goes enough faster than the preceding roll to take care of the increased length due to the reduction of 15% which each mill performs. The final speed is about 160 feet per minute.

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Figure 5 shows this machine in operation. You will note that the last 4 roll stands and the coiler are covered with a hood. This is part of the collecting system for oil fumes generated by the last 4 reductions. The oil fumes are precipitated electrostatically and return to the central oil system which lubricates the rolls with oil at 80° F. By electrostatic precipitation we recover about 1½ gallons of oil every 24 hours and prevent the fumes from causing hazardous and unpleasant conditions in our mill.

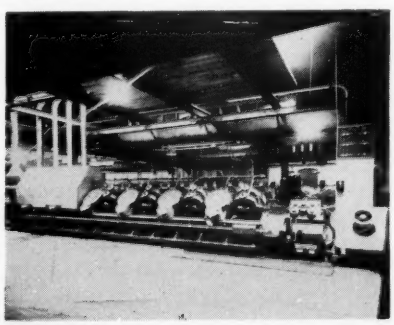

Figure 5.

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At this state the wire is annealed in a roller hearth bright annealing furnace. Then wire finishing over 0.072″ diameter is drawn to proper ready-to-finish size on single or multiple block heavy wire drawing machines. This is typical dry wire drawing using soap as a lubricant and tungsten carbide dies. The wire is then bright annealed again and drawn to finish size.

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Wire finishing smaller than 0.072″ diameter is taken in the soft condition at 11/32″ and rolled in a 10 roll tandem mill to 0.165″ square (77%) where it is again bright annealed. It is then drawn to ready-to-finish size, annealed again, and finish drawn. Drawing to about 0.100″ size is done dry while sizes below 0.100″ are done on multiple die wet wire drawing machines. Tungsten carbide dies are used to about 0.040″ diameter and diamond dies below that size.

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These wire blocks are wet drawing multiple die machines with speeds up to 1500 feet per minute. Individual drafts of 1 B&S number (20.8%) are used with total reductions up to 12 B&S numbers (94%) possible on fine sizes of 5% Grade A spring wire. Such heavy reductions are not possible or desirable, of course, on grades C and D phosphor bronze and can only be taken on Grade A phosphor bronze finishing below .025″.

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In these machines we use a water emulsion of fats for a lubricant and coolant, maintaining a fat content of 7% to 8%. City water with a pH of about 6.5 and a total hardness of 14 p.p.m. is used satisfactorily. A few years ago we used well water from our own plant and experienced considerable trouble with excessive die wear, which was found by investigation to have been caused by the high hardness of the well water. A change back to low hardness city water quickly cured our trouble.

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Annealing of phosphor bronze wire is performed in radiant tube roller hearth furnaces provided with gas generators to produce a "bright" atmosphere. This atmosphere, generated by endothermic cracking of propane gas, prevents oxidation or discoloration of the metal surface on annealing. The furnace is equipped with a cooling chamber so that the metal does not come in contact with air until it is less than 175° F.

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After spring wire is finish drawn, it is relief annealed. This is a low temperature (400° F.) anneal which serves to reduce the residual stresses and prevent brittleness from aging. This operation is done under a controlled atmosphere and must be carefully controlled in order to reduce the residual stresses without softening the wire.

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You have seen how bronze wire is made by a relatively simple process of rolling, annealing, and drawing. While the processes are simple in principle, they are relatively complex in practice and require close control. Yet these processes, perfected as they are, will in time be replaced by other, superior methods. We are sure, however, that phosphor bronze will be used even more in the future because of its outstanding properties.

Wire Association Convention Papers received too late for publishing in this issue will be published in the November and December, 1953 issues of WIRE AND WIRE PRODUCTS.

The Drawing of Shaped Steel Wire

by Vito J. Vitelli, Process Engineer
Metallurgical Engineering Department, Steel Wire Mills Division
John A. Roebling's Sons Corporation
Subsidiary of the Colorado Fuel and Iron Corporation
Trenton, New Jersey

Shaped steel wire has been drawn for many years at the John A. Roebling's Sons Corporation. The quality of the wire has always been considered good. Not too many years ago the process consisted of drawing a single shaped hole at a time on a single block wire drawing frame, through steel plates, with an intermediate heat treatment between draws, either patenting or annealing, plus a subsequent cleaning and coating after each heat treatment. Finally, after two or three single hole drawing operations the wire would be finished by two shaped holes of drawing, still on a single block wire drawing frame, to the finish size. With this constant shuttling back and forth among the heat treating department, cleaning house, and wire drawing frame, it is readily conceivable that the manufacturing cost of shaped steel wire was quite high.

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While substitution of shaped carbide dies for shaped steel plates began to take place at Roebling's in 1937 still not much work was done on changing the essential parts of the process. Shaped steel wire was still drawn a single hole at a time on a single block wire drawing frame. Because of the relatively small volume of shaped steel wire being processed, as compared to the volume of round steel wire, due to a greater need for attention in other fields where equipment and process changes were taking place, any improvements in the drawing of shaped steel wire were more or less neglected.

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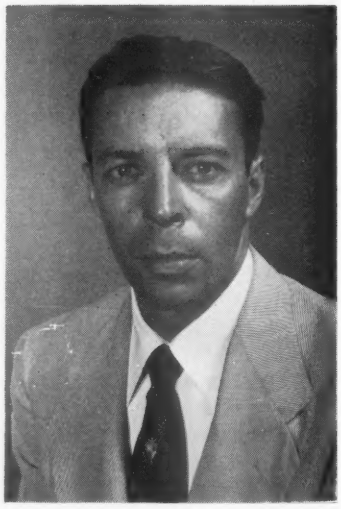
Beginning in 1949 a definite program was established to determine whether shaped steel wire could be drawn on continuous wire drawing machines with carbide dies, in a manner similar to round wire.

The author was graduated from Lehigh University in 1947 with the degree of Bachelor of Science in Metallurgical Engineering. He was employed by the American Steel and Wire Corporation, Trenton Works, in 1947. In 1948 he joined the Roebling Corporation as a Process Engineer in the Metallurgical Engineering Department, Steel Wire Mills Division.

His paper was prepared for delivery at the Annual Convention of The Wire Association in Chicago on November 10, 1953.



Vito J. Vitelli * * * * *

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Today at John A. Roebling's Sons Corporation all concentric shaped steel wires—squares, triangles, rectangles and trapezoids—finished in 22″ and 16″ mean diameter coils is drawn directly from a starting round rod or wire on continuous machines directly to finish size in one drawing operation. Both high and low carbon steel shapes are drawn. However, extensive experimentation had to be carried on with various coatings, wire drawing lubricants, drafting procedures, die designs, and wire drawing speeds before continuous machine drawing of steel shapes became a practicality.

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The determination of the best wire drawing coating involved studies with the following coatings: borax, sull and borax, sull and lime, light lime, heavy lime and phosphate coatings. In conjunction with the best coating determination, a compatible wire drawing lubricant had to be found. Different mixtures of various calcium stearate and sodium stearate base lubricants were tried. The best coating and lubricant practice, as determined by appearance of the finished wire and the amount of die wear, was found to be a heavy lime coat with a sodium stearate soap as a lubricant. However, the sodium stearate soap had to be leaned down with slaked lime for the best results. When used straight it would cause scraping of the wire.

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Drafting was more or less limited by the machines. It was found that a reduction of area of 22% to 24% per hole on the intermediate holes and a finish draft of 20% reduction of area on the last hole gave the best results. In addition a round first hole was found necessary because of the twist put into the wire by the flipping action of the pay-off stands. All twisting of the wire thus takes place in the round first die, as it does in regular

wire drawing, where its effects are inconsequential. After the first round hole the wire has no further tendency to twist other than that which might be induced by bad casting. However, this can readily be eliminated by proper casting on the first hole. In addition, care has to be taken that the wire is not twisted by hand during the stringing through the shaped dies. The machine must be strung with a complete lack of twist in the wire from one end of the machine to the other. Proper die orientation in each of the die holders greatly facilitates twist free stringing. Fig. 1 shows the proper die orientation for the various shapes, looking in the direction of drawing, or entrance of the die. The flat side that is to go against the block must be in a vertical plane. The twist-free stringing lessens the chances of creating scraped wire and the proper die orientation greatly facilitates the wire climbing the blocks.

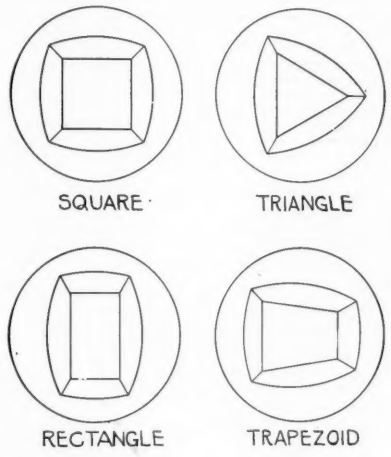

Figure 1.

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Wire drawing speeds had to be kept relatively slow in order to eliminate scraping and tearing of the corners, help die life, and insure the proper filling of the various shapes at each hole. It was found that too great a drawing speed drastically reduced die life and resulted in poor quality wire. Also the corners became scraped and torn and showed a tendency to "suck down" and become too rounded.

From the foregoing discussion, it can now be determined that all concentric shaped steel wire drawing practices for wire finished in 22″ and 16″ mean diameter coils are essentially as follows:

1. **Patent (rod or round wire)**
2. **Clean—heavy lime coat—bake**
3. **Machine draw 1 round hole, 2 to 4 shaped holes to finish size.**

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The number of shaped holes of drawing is dependent upon the final size, shape and physical properties desired. If the shaped steel wire is to be supplied in the bright hard drawn state rather than a heat treated finish — oil tempered or annealed — then the greater number of shaped holes is generally used. The size range of shaped steel wires drawn in 16″ and 22″ mean diameter coils varies from .050″ to .150″. Fig 2 shows the direction of measurement for determining the nominal sizes of the various shapes as done at Roebling's. The direction of measurement can become a source of confusion if not standardized, particularly with the triangle and trapezoid shapes.

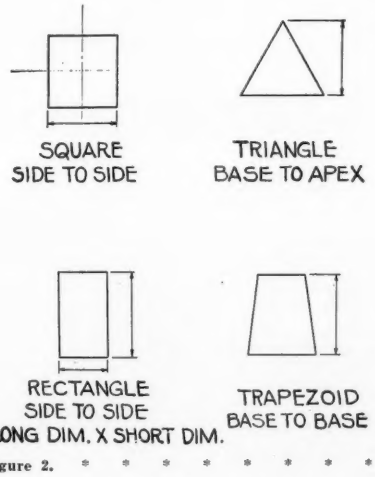

Figure 2.

Shaped steel wires greater than .150″ in size are generally drawn in 30″ mean diameter coils. These larger sizes have been successfully continuous machine drawn, but the large size and consequent stiffness of the wires involved did not permit easy twist free stringing of the machine. Because of this the practice was deemed impractical. Consequently all shaped steel wires drawn into 30″ mean diameter coils are drawn in a 30″ single block wire drawing frame. However, the drawing is still a single operation in that no intermediate heat treatments are involved. The same coating, lubrication, and die orientation procedure as previously outlined for machine drawing are followed. The round first hole is eliminated since the wire is drawn from a revolving swift and no twisting of the wire takes place between the swift and first die. However, care must be taken in stringing the intermediate holes so that the wire enters the die with its sides in the proper planes with respect to the orientation of the die.

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In addition to the larger sized shaped steel wires eccentric shaped steel wires are also drawn on single block wire drawing frames. The eccentric shape to be discussed is used in Locked Coil Tramway Strand and is shown in Fig. 3.

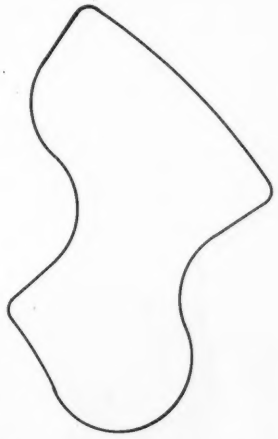

Figure 3.

Fig. 4 shows how these ESS-shaped wires are used in Locked Coil Tramway Strand construction. This ESS-shaped wire is drawn from a shaped rod and is the only shaped wire drawn at Roebling's that is not processed from a round rod or wire.

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The ESS-shaped wire received an extensive study in conjunction with the work being carried on

Engineered, finest in

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WIRE DRAWING MACHINES - STRANDERS - DIE STRINGERS - CONTINUOUS ELECTRIC ANNEALERS - PAY

to be the...

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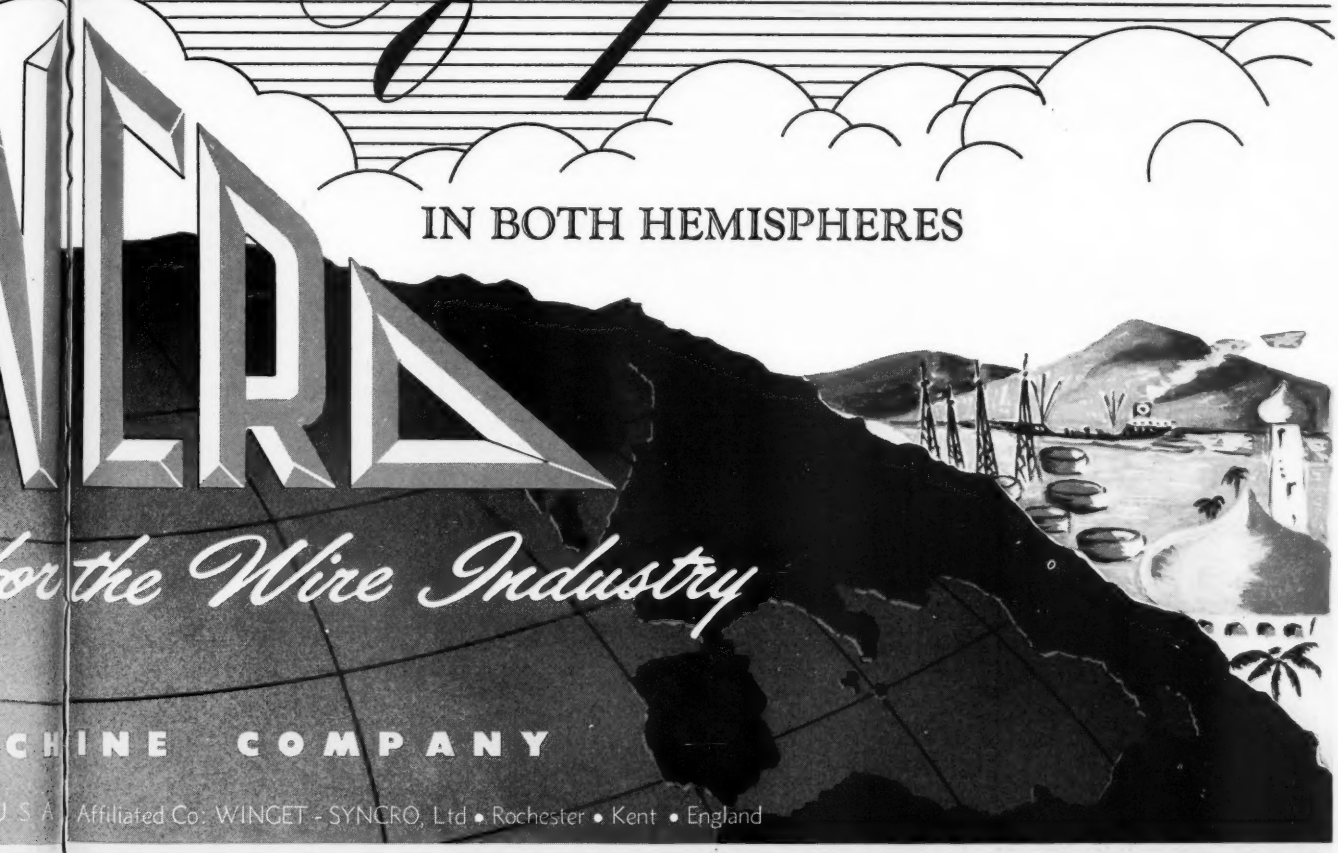
Equipment.

IN BOTH HEMISPHERES



for the Wire Industry

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with the concentric shaped wire. However, the fact that the wire

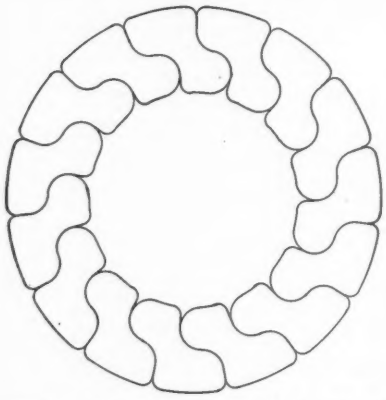

Figure 4.

is processed from a shaped rod ruled out the possibilities of machine drawing since the wire must be run from a swift rather than a pay off stand with its subsequent twisting action. Running the wire from a swift and stopping the machine for welding proved impractical because of the difficulties involved in aligning the shaped rod during the butt welding operation. Four sizes of this ESS-shaped wire are now being made at Roebling's. The sizes vary from .186″ to .192″ as measured from the top to the bottom of the shape, as shown in Fig. 3. The size at the narrow section or throat is approximately .090″. The previous wire drawing practice called for each individual size to have its own starting shaped rod. The hot rolled shaped rods were patented and cleaned, drawn one hole, patented and cleaned, drawn one hole, patented and cleaned and drawn two holes to finish—a total of three patentings, three cleanings, and three drawing operations. Since the finish sizes are of the same order this particular products practice was revamped so that one shaped rod now serves for all four finish sizes. The present practice consists of cleaning and coating the hot rolled shaped rod and drawing one shaped hole. A common first shaped hole is used for all four finish sizes. The wire is then patented and cleaned and drawn three shaped holes to finish size on a 30″ single block wire drawing frame. This practice eliminated two patentings, one cleaning and one drawing operation. The wire is pointed on an electric stretch pointer. A lime coating and sodium stearate soap are again applied.

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All shaped dies used at Roebling's, with the exception of the dies used for the ESS-shaped wire, are made in the Roebling Shaped Die Shop from round hole carbide dies with R-3 and R-5 nibs. The ESS-shaped dies are purchased from an outside die manufacturer as rough cored shapes and finished in the Roebling Shaped Die Shop. Enlarged cross sectional drawings of each shaped hole are used in conjunction with a shadowgraph machine in making the dies. The drawings are made by a draftsman to the dimensions and reductions of area between holes called for by the wire drawing practice.

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The intermediate shaped holes are made with flat sides rather than curved sides. If cross sections of each hole of drawing were superimposed on each other the sides of the intermediate shapes would be practically parallel to the sides of the finish wire. Fig. 5 illustrates this parallel side principle for square and triangle shaped wire. The purpose of the parallel sides, that are flat rather than curved, is to cause the wire to hit the approach of the succeeding die at the same distance from the bearing on all sides. This type of intermediate die design has given better die life than designs where the shapes are gradually worked down from a round to the finished shape. This parallel side principle is also applied to eccentric shapes. Figs. 6, 7, and 8 are scenes of the Roebling Shaped Die Shop and show three of the major phases of shaped die making, machining shaped tools, checking the size of a shaped die by means of a shadowgraph, and final polishing of a shaped die.

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At Roebling's the continuous machine drawing of concentric shaped steel wire is considered to be a practical wire mill operation. The basic components of the process consist of (1) patenting (round rod or wire), (2) cleaning and

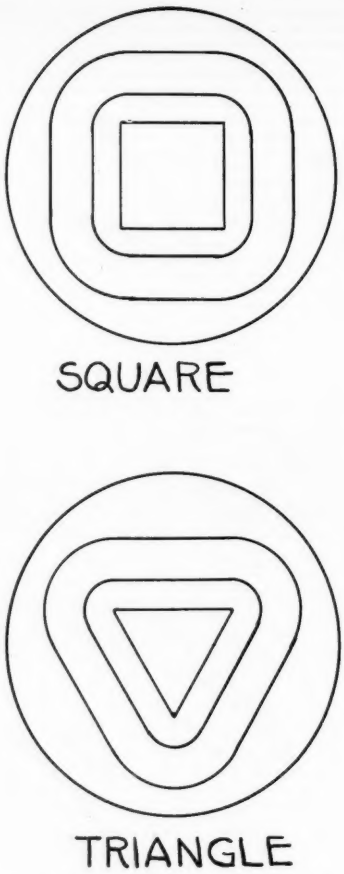

Figure 5.

heavy lime coating and (3) drawing a round first hole and two to four shaped holes to finish size with a drawing lubricant consisting of sodium stearate soap leaned with slaked lime. Flat sided intermediate shaped holes are used.

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This work was carried out under the direction of the Research and Development Department and the Metallurgical Engineering Department, Steel Wire Mills Division.

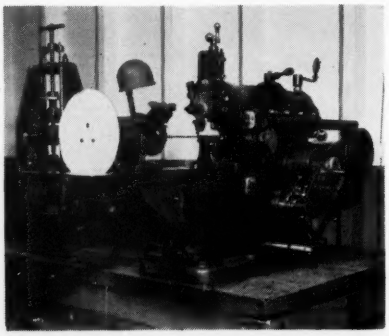


Figure 6.

(*Please turn to page* 1145)

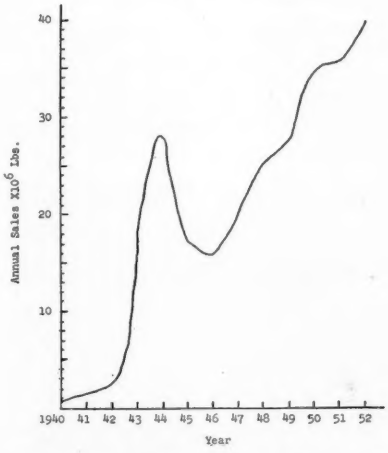
Neoprene Coverings for Weatherproof Wire

by C. E. McCormack and R. H. Baker
Rubber Chemicals Division
E. I. duPont de Nemours & Company, Inc.
Wilmington, Delaware

The use of neoprene compositions for covering weatherproof wire, including line and service drop wire, has increased to such an extent that they give every indication of becoming the standard of the industry. When neoprene was introduced in 1931 as the first general-purpose synthetic rubber, one of the first major divisions of the rubber industry to investigate it carefully was the wire and cable industry. In spite of an introductory price of $1.05 at a time when natural rubber was selling for $0.05 per pound, its unique resistance to severe service conditions such as exposure to sunlight, heat and corona, and contact with oils and chemicals soon led to its adoption as the standard jacketing material for use on wire. Figure 1 shows the growth curve of the use of neoprene in the wire and cable industry, and clearly indicates that this progressive group is still increasing markedly its utilization of this elastomer.

FIGURE 1

CONSUMPTION OF NEOPRENE IN THE WIRE AND CABLE INDUSTRY

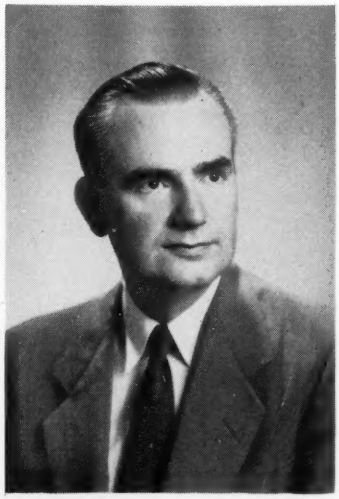


Mr. McCormack received a BS degree in Chemical Engineering from the Massachusetts Institute of Technology in 1932. He was associated with the O'Sullivan Rubber Company until 1940, when he joined the E. I. du Pont de Nemours and Company. Following three years in neoprene production, he was transferred to the Rubber Laboratory and at the present time he is a Division Head in charge of the technical work on the application of neoprene to the wire and cable industry.

The co-author of the paper, R. H. Baker, attended Lafayette College and the University of Pennsylvania. He has been associated with the Rubber Chemicals Division of the E. I. du Pont de Nemours & Company for twenty-five years and has been working with neoprene in various capacities since its introduction in 1931.

This paper, which discusses the properties of neoprene that make it suitable as a weatherproof wire coating, was prepared for delivery at The Wire Association's Annual Convention in Chicago on November 10, 1953.

Neoprene compositions were first introduced as coverings for line wire on both aluminum and copper conductors about 8 years ago. Following closely behind the use in line wire, neoprene coverings were introduced in service drop applications, both in the open wire and triplex constructions. Some idea of the success of neoprene coverings on weatherproof wire can be gained from the fact that this application is now consuming about 10,000,000 pounds of neoprene per year.



C. E. McCormack * * * *

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Properly compounded neoprene coverings have a balance of properties which make them especially well suited for the complicated set of conditions to which weatherproof coverings are subjected. This paper is concerned primarily with a discussion of those properties of neoprene compositions which are responsible for their successful use as coverings for weatherproof wire. A list of properties required in a weatherproof covering, including line and service drop wire, is as follows:

Resistance to:

1. **Damage during installation**
2. **Abrasion**
3. **Compression cutting**
4. **Weathering**
5. **Corrosive atmospheres**
6. **Temperature changes**
7. **Outages due to grounding**

Resistance to Damage During Installation

An outstanding property of neoprene coverings is their resistance to damage during installation. This is particularly important because it is not always possible to control the exact handling of the wire. This is sometimes due to the limited experience of members of the installation crews and at other times simply to the vagaries of human nature. It can be assumed that wire is at time subjected to rough treatment such as being dragged over sharp stones and even being run over by automo-

biles and trucks. In addition to these abnormal treatments, weatherproof coverings must withstand the normal abuse entailed in the use of a come-along and the dragging over crossarms. Neoprene covers are inherently resistant to the stresses, strains and cutting actions involved during installation. As shown in Table I, commercially produced coverings have high tensile strength values and can be elongated several hundred percent without rupture. In addition, their high degree of resilience makes them very resistant to permanent distortion and is largely responsible for their resistance to the cutting action of sharp objects.

TABLE I

Physcial and Electrical Tests on Commercial Weatherproof Wire

Code Number	A	B	C	D	E	F
Conductor	Copper	Aluminum	Copper	Copper	Copper	Copper
Physical Tests						
Tensile Str.,psi ..	2125	2050	1500	2300	1775	1975
Elongation at Rupture, %	490	480	340	380	440	600
Electrical Tests - 3/64-Inch Wall						
Insulation Resistance, megohms/1000 feet	2.6	0.6	1.6	1.5	4.7	3.4
Power Factor, % ...	6.2	5.0	7.4	6.9	5.5	4.6
SIC	10.1	11.8	19.0	14.5	11.2	7.9
Breakdown Voltage, KV	18.5	15.0	8.7	10.0	14.0	20.0

Neoprene coverings have sufficient adhesion to the conductor to prevent sleeving when pulled over crossarms, and yet not enough to prevent easy stripping in making connections.

Resistance to Abrasion

Neoprene has found use in many applications where resistance to abrasion is an important requirement. For example, it is used in substantial quantities in shoe soles for industrial type shoes, and also in many mechanical goods applications such as conveyor belting and industrial hose, in addition, of course, to its extensive use in cable jackets. Weatherproof wires are not tree wire as most transmission and distribution men will agree, and should, therefore, not be subjected to severe tree abrasion. Nevertheless, neoprene coverings will withstand a reasonable amount of this type of abrasion without failure. Where such conditions prevail, however, it is recommended either that the trees be trimmed or additional protection be provided for the weatherproof wire.

Resistance to Compression Cutting

Resistance to compression cutting is of importance in line wire at dead-end insulators and also at pole top insulators where the lineman makes his tie. The pressure exerted at the tie wires is largely dependent on the lineman's technique, but under normal conditions cutting through the neoprene covering should not be a problem. Tests on commercially produced neoprene line wire using the apparatus shown in Figures 2 and 3 showed that the neoprene covering was not cut through after 3 years under a tension of 200 pounds. Resistance to compression cutting is also a factor in triplex service drop where a cut through could cause a short circuit. Experience has shown that neoprene covered triplex drops are especially resistant to this type of damage.

Resistance to Weathering

No single factor has contributed as much to the commercial success of neoprene as its resistance to weathering. This applies not only to its extensive use in wire and cable, but also to its use in a variety of mechanical goods items and such things as meteorological balloons. Laboratory tests are useful tools in the evaluation of weather resistance, but are not a substitute for long-term outdoor exposure tests. The value of laboratory tests increases with increasing knowledge of the outdoor performance of the basic material in a variety of formulations. Much

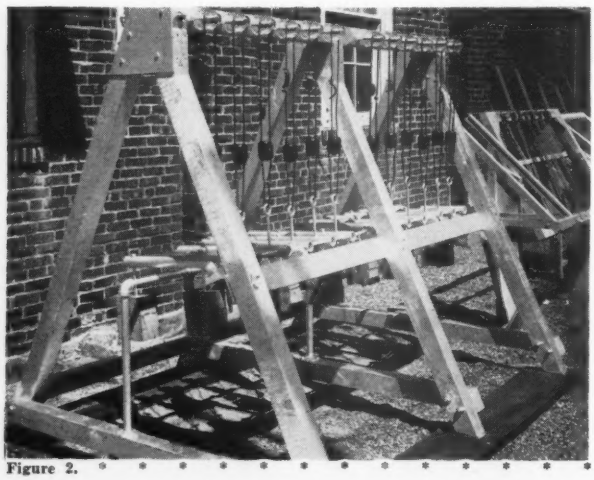

Figure 2.

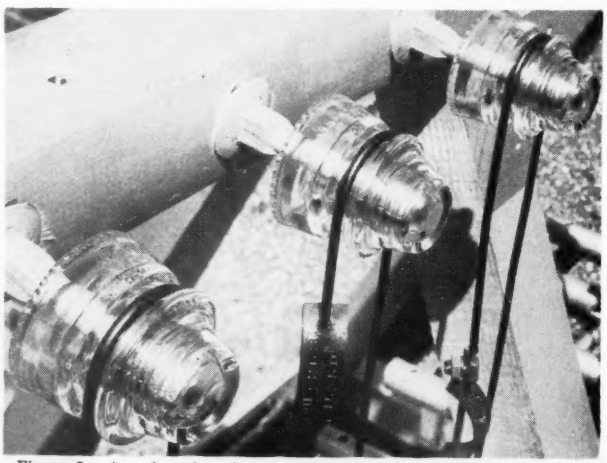

Figure 3.

is known about the weather resistance of neoprene compositions as a result of its commercial use for many years in outdoor applications. Weatherproof compounds, while not produced commercially for as many years as jacket compounds, exhibit the same characteristic aging pattern, both in outdoor tests and in laboratory oven and Weather-Ometer tests. Neoprene compounds, designed for outdoor use, exhibit a gradual stiffening as a result of outdoor exposure and this is reflected in some increase in hardness and a lowering of elongation. The change in elongation is greater during the first year or two than in subsequent years and with prolonged aging the elongation tends to stabilize at a safe level. Weatherproof and jacket compounds do not develop any surface cracks as a result of oxidation, nor do they develop cracks due to attack by atmospheric ozone. As evidence of the good weathering of properly compounded neoprene compounds, some of the leading manufacturers of wire and cable have reported neoprene jackets to be in excellent condition after 15 to 18 years' exposure. Combining this background of experience on neoprene compositions with extensive laboratory tests on neoprene weatherproof coverings, it seems safe to predict that few installations will ever fail from weather aging.

Resistance to Corrosive Atmospheres

Resistance to the corrosive atmospheres of industrial areas is a requirement for any general-purpose wire covering. Both laboratory and service tests have shown that neoprene compositions are extremely resistant to essentially all of the corrosive substances normally found in the atmosphere in industrial areas. In addition, both neoprene jackets and weatherproof coverings have given excellent performance in industrial areas and in chemical plants.

Resistance to Temperature Changes

Neoprene coverings, because they are thermosetting, are not damaged by short-term exposures to temperatures as high as 225°C. While temperatures of this magnitude would not be expected to occur very often, they probably are reached under short circuit conditions. Neoprene coverings are also resistant to damage resulting from exposure to low temperatures. Without resorting to special compounding, neoprene compounds withstand a sharp blow down to —40°C, and with special compounding down to —55°C. It is, thus, apparent that neoprene coverings can be expected to provide continuity of service in spite of exposure to extremes of temperature.

Resistance to Outages Due to Grounding

The maintenance cost of weatherproof line wire is dependent to a considerable degree on its resistance to grounding as a result of contact with tree branches, or to short circuiting by foreign objects across the lines. Failure of the covering can result almost immediately if the impressed voltage exceeds the breakdown voltage of the covering and delayed failure can come about with lower voltages as a result of damage to the cover by corona discharge. The resistance of neoprene coverings to dielectric failure depends to a large extent on the nature of the compound, and typical breakdown voltages are shown in Table I. These values show that properly compounded neoprene coverings have considerable resistance to dielectric failure. In addition, on the basis of laboratory tests on coverings removed from the conductor and stretched up to 100%, there is reason to believe that breakdown voltages are not appreciably affected by the distortions which may occur in service installations. Commercial neoprene weatherproof coverings have outstanding resistance to corona discharge. This can be demonstrated in the laboratory by a test developed by one of the large utilities. It consists of wrapping a 12-inch length of weatherproof wire with two turns of copper gauze, 3 inches in width, and applying 4800 volts AC across the conductor of the weatherproof wire and the gauze wrapping. Tap water is applied to the gauze once each day. Commercial neoprene weatherproof wires meet the acceptance requirement of 4000 hours' exposure to this test by a very wide margin.

Specifications and Properties of Commercial Coverings

During the past three years, Committee No. 12 of the American Standards Association has been very active in developing a specification for neoprene weatherproof wire. The results of the Commit-

(*Please turn to page* 1144)

TABLE II

Specification Requirements

	ASTM D 752	Suggested ASA Specification
Physical Properties		
Unaged		
Tensile Strength, psi	1800 min.	1400 min.
Tensile Stress at 200% Elongation, psi	500 min.	-
Elongation at Rupture, %	300 min.	250 min.
Set in 2-inch gauge length, inches	3/8" max.	3/8" max.
After 96 Hours in Oxygen Bomb at 70°C		
Tensile Strength, psi	1600 min.	75% of unaged, min.
Elongation at Rupture, %	250 min.	65% of unaged, min.
After 168 Hours in Air Oven at 70°C		
Tensile Strength, psi	1600 min.	-
Elongation at Rupture, %	250 min.	-
After 18 Hours in Oil at 250°F		
Tensile Strength, psi	60% of unaged, min.	60% of unaged, min.
Elongation at Rupture, %	60% of unaged, min.	60% of unaged, min.

Handling and Storing of Wire and Wire Products

by C. C. Tappero
Superintendent Wire Mills
Pueblo Works
Colorado Fuel and Iron Corporation
Pueblo, Colorado

Construction of our new Morgan Rod Mill, which produces a 700 pound rod bundle, required different methods and facilities at the wire mill for handling rods and wire. To convert the increased rod tonnage, made available by the greater capacity of the new rod mill, additional drawing and fabricating equipment was installed throughout the wire mill in space formerly utilized for storage of in process wire and finished wire products. Loss of storage space to producing equipment required more efficient utilization of remaining storage area with particular emphasis on full utilization of available volume.

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Rod bundles from our old Garrett Mill weighing 165 pounds were delivered to the Wire Mill rod dock by a flat cable conveyor. Rods were manually positioned on edge in a rack at the end of the conveyor. As a pin load of approximately 2500# of rods was accumulated they were picked up and placed in stock or delivered to the cleaning house by means of an overhead monorail crane system.

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Delivery from cleaning house to drawing machines was made by ram truck. Wire drawers manually loaded the bundles onto conventional type rod flips. Wire was stripped from drawing machines at 165 pounds, although rod bundles were welded for continuous drawing. Drawn wire was delivered to the processing departments by tractor and trailers where it was manually unloaded into stock or onto pay-off reels. Similarly, wire from processing units such as annealing and galvanizing, was manually loaded onto trailers for delivery to subsequent fabricating units. The four-wheel trailers used were similar to those seen in many wire mills, consisting of a cast iron frame with a steel rack. Their capacity was approximately 5,000 pounds of wire.

The author was born in Colorado, and graduated from the Colorado School of Mines in 1935 with an Engineer of Metallurgy degree. After some work in non-ferrous metallurgy, he entered the Industrial Engineering Department of the Colorado Fuel and Iron Corporation, and became Assistant Superintendent of that department. He was later promoted to Superintendent of the Combustion Department, and in 1950 was made Superintendent of the Wire Mills, Pueblo Works.

His paper was prepared for presentation at the Annual Convention of The Wire Association in Chicago on November 11th, 1953.

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Finished products were loaded onto trailers or platform truck skids for delivery to the warehouses where they were manually placed into piles. Piling of products too heavy for manual handling was accomplished by the assistance of fork or platform lift trucks. An exception was welded fabric where overhead crane service was available. Shipment of wire products was also a manual operation aided by tractor and trailers to transfer products from warehouses to railroad cars or highway trucks.

C. C. Tappero * * * * *

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Construction of the new rod mill at a site some distance from the old mill precluded use of the existing conveyor system for delivery of rods. They are now delivered by two electric powered trains shuttling between the rod and wire mills. Each train, in addition to the engine, consists of two flat cars with rod back up racks. Each train can be loaded with 100 bundles of rods in twenty rows of five bundles. The weight of rods transferred per trip is approximately 35 tons.

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Rods are not stocked at the rod mill, but are loaded directly from the hook: conveyor onto the shuttle train. Therefore, the train at the wire mill must be unloaded and returned to the rod mill in time to replace the other train immediately after it is loaded in order to maintain continuous rod mill operation.

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As can be seen in Figure 1, dock, cars and racks are so designed that

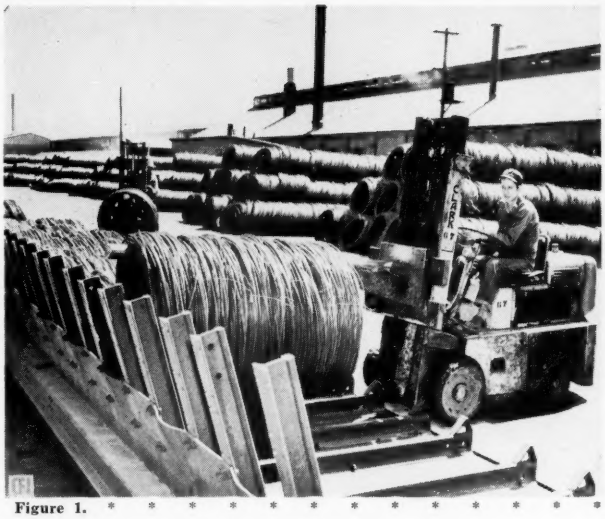

Figure 1.

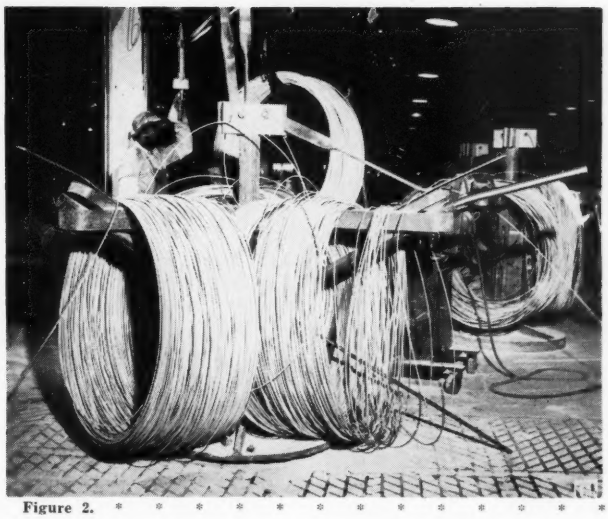

Figure 2.

rods can be unloaded by ram truck. Each row of five bundles of rods comprises a unit load. Two gasoline powered trucks are used for unloading, stocking, setting shipping rods under the gantry crane for loading into railroad gondola cars, and servicing the cleaning house. These trucks are standard lift trucks capable of stacking rod bundles in rows three high.

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Rods are processed through the straight line cleaning house in unit loads of five bundles per pin. They are placed on the pins by the rod dock ram trucks. The charging pin rack will contain 8 pins which enables the truckers to maintain sufficient charged pins ahead of the cleaning house crane so that they can concentrate on unloading the shuttle train when it is at the dock.

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Ram trucks are used to remove rods from the pins deposited on the cleaned rod pin rack at the end of the cleaning line. These trucks place rods in storage and deliver to drawing machines where rods are set against back up racks located under the charging hoists.

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Three methods were considered for handling and paying off 700 pound rod bundles behind the drawing machines:

1. **Conventional type flips, two for each machine.**
2. **Detachable fork truck rams which would be placed on permanent racks with space for two rams per drawing machine, each ram to hold five bundles.**
3. **Revolving flips with three stems, each stem being charged with a 700 pound bundle.**

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Due to the limited aisle and floor space behind drawing machines, revolving flips were adopted. Flips are shown in Figure 2: Each is charged with three 700 pound bundles. After depleting a bundle, the flip is rotated to pay off the next bundle which has been prewelded to the previous bundle. This method requires more effort on the part of the operator in loading the flip using a bridge crane hoist, than the second method mentioned above. However, there is a compensating factor in that the effort required to separate the rod ends for trimming and welding to the previous bundle is less than that required when the rods are on one long stem. Wire is now stripped from the drawing machines in bundles ranging in weight from 175 pounds to 700 pounds, depending on gauge and end use. Bridge crane hoists have been installed over the pay off reels of processing units such as galvanizing and nail machines to enable the operators to handle these bundles. Transporting drawn wire from drawing machines to other processing units is done by fork lift trucks and skids in lieu of tractor and trailers. Skids can be seen in Figure 3. They were designed to utilize structural sections rolled at our Pueblo plant such as angles, channels and flats. The average load per skid is 4,000 pounds of wire. While handling larger unit loads would be preferred, aisle space limited the size of skids used.

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Advantage of skids over trailers is their stackability, thereby reducing floor space required to store a given quantity of wire. Using standard 6,000 pound capacity fork trucks, the skids may be stacked three high. Based on an average load of 4,000 pounds per skid, an average of two skids per stack, and allowing for clearance between stacks, approximately 1.75 square feet of floor space is required per 1,000 pounds of wire. When storing wire on trailers, approximately 3.5 square feet were required per 1,000 pounds. Therefore, installation of skid handling has enabled us to reduce storage space required for wire approximately 50%. In addition to wire for processing departments, the bulk of our bundled shipping wire is also stocked in skids.

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Annealed wire and 20 gauge galvanized wire is loaded into skids for transfer to using departments. Galvanized wire coarser than 20 gauge is transported by ram truck. Bundles are positioned on edge in rows by the galvanizing blockers. From this position, they are picked up by the ram trucker and transported to the using department where the driver places them in stock piles. While the above method of handling and storing coarse galvanized wire has not reduced the storage area required, it has materially re-

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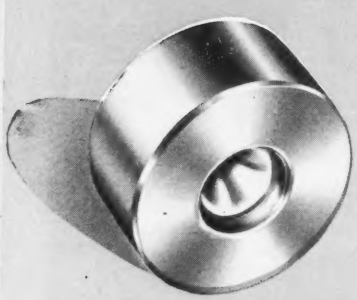
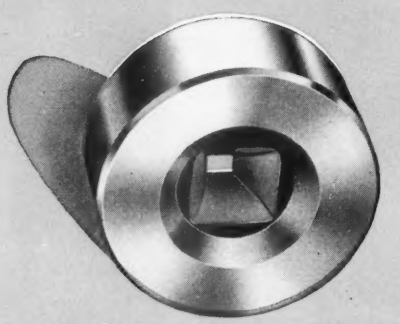
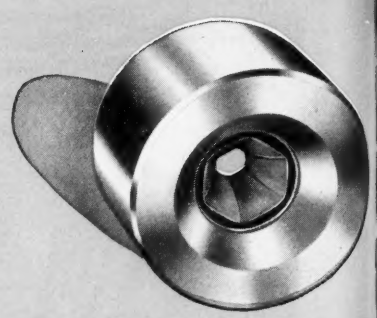


Round-Hole Dies

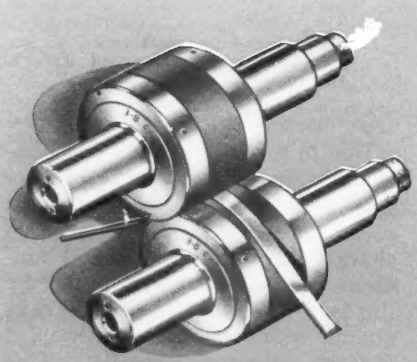


Square-Shape Dies

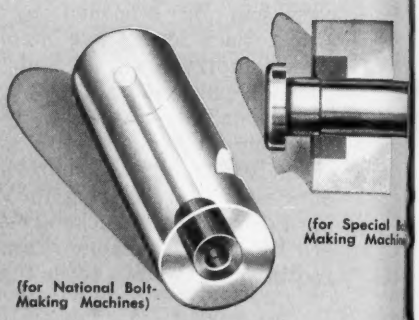


Hex-Shape Dies

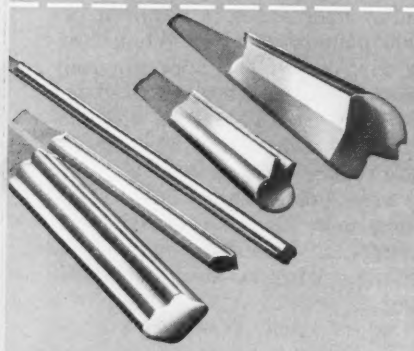
Capstan Rings



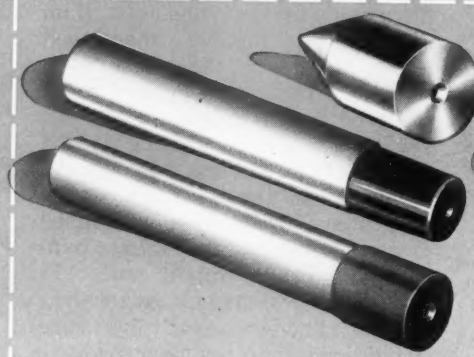
Wire-Flattening Rolls



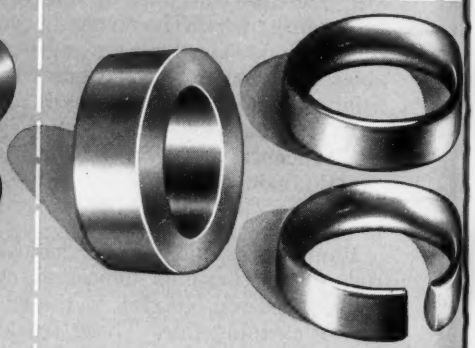
Extrusion Die Nibs



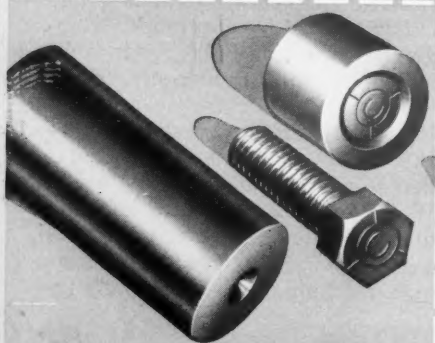
Special-Shape Dies

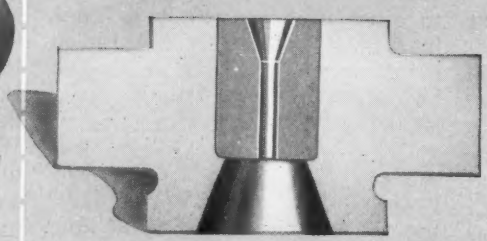


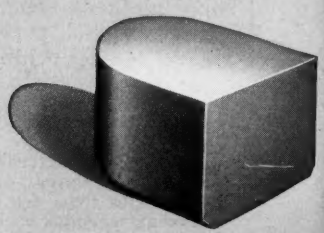
Mandrels and Mandrel Nibs



Bushings, Rings and Slotted Wire Guide







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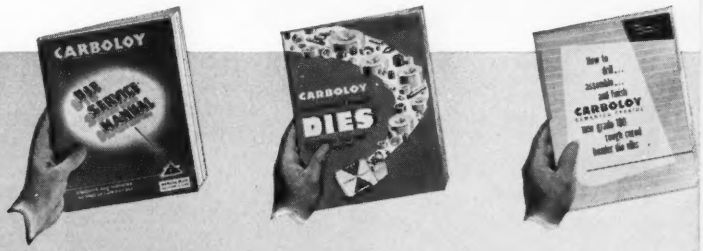

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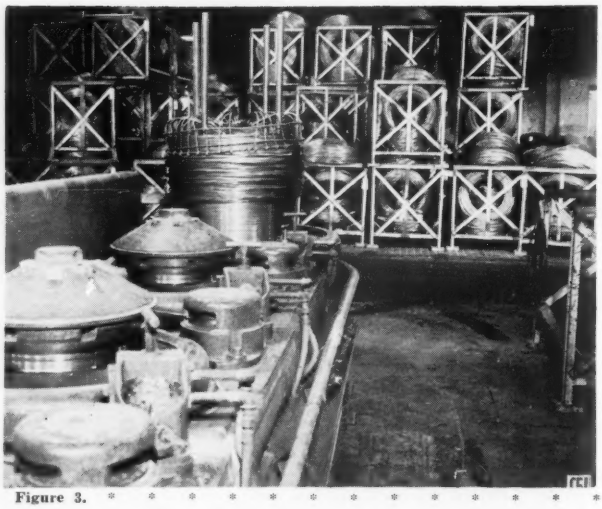

Figure 3.

Figure 4.

duced cost of handling from that experienced when trailers and tractors were used to transport galvanized wire which was loaded and unloaded manually.

★ ★ ★

Installation of additional fabricating equipment on floor space formerly used for storing production, coupled with increased production from the new machines required that more efficient use be made of remaining storage areas. Methods of handling and storing finished products were completely revised to the extent that all products are either palletized, placed in stackable skids or bundled in unit loads that can be stacked by fork trucks using wood spreaders between each load.

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Products that will not be damaged by the load of a stack such as nails, fence, stucco netting, coiled baling wire, cinch stays, general purpose welded fabric and barb wire are palletized. Items that would be damaged by the weight of a stack are stored in stackable skids which carry the load. Figure 4 shows a portion of the fence warehouse and the two methods of stacking products on pallets and in skids. The warehouse volume that can be efficiently used is considerably greater than when products were stacked manually or by the assistance of a fork or platform truck. It is estimated that the change in method has resulted in increasing our warehouse capacity by 30%. Further, the cost of warehousing and shipping has been materially reduced along with the quantity of products damaged in handling.

Warehousing of fence post, nails and bailing wire are shown in Figure 5. The racks are used to store small quantities of nails where the volume of the particular type of nail is less than a full pallet load. Fence posts are bundled in unit loads of 250 posts, and are stacked by using spreaders between each unit load.

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Loop bale ties are stored in skids as shown in Figure 6. Similar to fence posts, their length precludes transporting by fork truck due to limited aisle and dock widths, therefore, they are placed on trailers and towed by fork truck. Storage of barb wire, coiled baling and nails in kegs and boxes is shown in Figure 7.

Figure 5.

Figure 6.

Figure 7. * * * * * * * *

Size of pallet used was limited principally by the eight foot wide loading docks running along the sides of our warehouses. It was determined that with our docks, a 4,000 pound capacity gasoline powered fork truck carrying a 4′ x 4′ pallet was about the maximum length and width of truck and load that could easily maneuver into and out of railroad cars. While slightly larger pallets would clear, it was found that the added size was insufficient to accommodate an additional row of nails, barb wire, fence etc. Inasmuch as the 4′ x 4′ pallet provided sufficient area to insure a stable stack, along with the fact that the life of pallets is improved when the loads completely cover or slightly overhang the pallet, this size was adopted.

★ ★ ★

Non-reversible pallets are used since, in some operations due to limited aisle space, it is necessary to use transporters to transfer the pallet load to the warehouse. Pallets are made of hardwood with 3 3″ x 4″ stringers, maximum of 1″ spacing between 1″ thick boards on the top face and the usual openings in the bottom face to accommodate transporter wheels.

★ ★ ★

Stackable skids for light fence and netting, also skids for bale tie are made from standard structural sections. The fence skids have wood decks which are similar to a pallet. They are not fastened to the steel frame so that various widths can be used to insure adequate support for the higher fences.

★ ★ ★

Mechanical handling of products such as nails and of incoming supplies such as zinc, fluxes, paper cartons, cooperage etc., has also been installed. Nails were formerly transferred from the cutting room to the rumblers by means of manually pushed buggies. These have been replaced by tote boxes which are hauled and dumped by fork trucks. Figure 8 shows the tote box which will hold approximately 10 kegs of nails. The box is designed with off-center trunnions so that when the truck operator places the box on a cradle at the rumblers, it dumps as the forks are withdrawn. These boxes are stackable with a view to conserving space. Due to their low height, they can be placed under the discharge chute of the larger nail machines, thereby eliminating handling of nails by the helpers.

Figure 8. * * * * * * * *

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Although the primary purpose of converting to mechanical handling was to conserve floor space and provide means of handling 700 pound rod and wire bundles, reduction in cost of handling, resulting from the change, in itself fully justified the expense involved. Indirect benefits obtained are reduced maintenance of floors due to elimination of steel-wheeled trailers, reduced accident hazard by elimination of excessive manual handling, improved housekeeping, improved yields resulting from larger starting bundles and a reduction in damaged materials and products from handling.

JOIN THE WIRE ASSOCIATION

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THE WIRE ASSOCIATION

RICHARD E. BROWN, *Executive Secretary*

453 Main Street **Stamford, Conn.**

Components of Wire Drawing Lubricants

by Leon Salz, Manager
Lubricants Division
Magnus Chemical Company
Garwood, New Jersey

How often do we purchase something of difficult measurable quality such as furniture, a suit of clothes, or a steak, realizing that only its usage or consumption will tell us whether we have bought wisely? We resort to buying a so-called "cat in the bag," and depend upon the reliability of the vendor to give us dollar value, because the limitations of time do not permit us to make a thorough investigation of the subject.

★ ★ ★

All of us here are directly or indirectly concerned with the manufacture of wire—and with the ways and means of doing that job most efficiently. The use of wire drawing lubricants, their selection and proper application, is a very essential part of the manufacturing process. While many of us may be satisfied to rely entirely on the judgment of the lubricant manufacturer to supply the proper product, it is believed that a knowledge of the raw materials used in their manufacture will often assist in diagnosing and remedying production difficulties related to lubrication. A problem in applying a uniform liquor coating, for example, may be traced to the use of the difficult cleaning calcium types soaps as the dry drawing lubricant. Knowledge of the subject would enable us to know that the use of a sodium soap might have been adequate for the dry drawing job and offer the advantages of easier and complete removal from the wire. The importance of technical information in regard to wire drawing lubricants cannot be overemphasized.

The author graduated in 1940 from New York University with a degree of B.S. in chemistry and from the University of Michigan in 1941 with an M.S. in chemistry, after which he took specialized training at the Polytechnic Institute of Brooklyn in lubricants. After two years with the Crane Packing Company, Chicago, he went with the Socony-Vacuum Laboratories, becoming a Senior Chemist on metal working lubricants. In 1950 he joined the Magnus Chemical Company as Manager of lubricant patents and has written several technical articles on the subject. Mr. Salz is a member of The Wire Association. The American Chemical Society and the American Society of Lubrication Engineers. **This paper was prepared for presentation before the Annual Convention of The Wire Association in Chicago, Illinois on November 9th, 1953.**

Functions of Components

When a manufacturer compounds a wire drawing lubricant, each component is added for some specific purpose. Fats, fatty oils and soaps are the most commonly used lubricity materials. These components have the property of strong physical adherence to the wire under conditions of high pressure and, thereby, minimize friction and wear. Water soluble type soaps are excellent materials for wire drawing formulations because, in addition to their lubricity characteristics, they function as emulsifiers for fats and fatty oils, rendering these materials water dispersible. Furthermore, water soluble soaps lower the surface tension of water, which is the basis for their function as wetting agents and detergents. The water insoluble soaps have higher melting points than the soluble varieties and are therefore desirable in dry drawing operations where considerable heat is developed. Both water soluble and insoluble soaps have the capacity to gel mineral oil and are, therefore, used in the manufacture of petroleum greases.

Leon Salz * * * * * *

★ ★ ★

The use of lime in dry drawing formulations is to reduce the rich lubricity of straight soap and give proper balance to the frictional characteristics required. Water serves as a coolant, being one of the best materials known for the dissipation of heat. The function of mineral oil in a drawing lubricant is to act as a carrier or diluent for the lubricity and/or extreme pressure material blended in it and, secondly, to serve as a coolant. Heat resistant solid lubricants such as graphite, mica and talc, are used where high temperature conditions of operation do not permit the use of fats, oils or soaps. The solid lubricants may also serve along with lime and chalk as pigments in mechanically separating the wire from the die. Chemical type extreme pressure components such as chlorinated and sulphurized compounds react with the wire during the drawing operation to form protective chemical coatings

which minimize welding and seizure.

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The specific compound selected from a group of related materials and the concentration in which it is used is generally determined by the manufacturer's experience in field tests and by cost considerations.

What Are "Oils"?

The term "oils" denotes so many different meanings to individuals who speak of them that I believe it would be wise to first clarify the technical differences. Loosely used, "oils" refer to substances having the property of possessing a greasy feel. Technically, there are three principal categories in which oil can be classified, each group differing very substantially from the other in chemical and physical characteristics. These groups are mineral oils, fatty oils and essential oils. The mineral oils are derived from refining crude petroleum, which is found in nature underground. Chemically, mineral oils are a complex mixture of compounds containing carbon and hydrogen as the principal elements. Motor oil, fuel oil and machinery lubricating oils are examples of products which are largely mineral oil in composition.

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Fatty oils are of animal and vegetable origin and are compounds, called glycerides, formed by the chemical union of glycerin and fatty acids (such as stearic, oleic and palmitic acids). Examples of fatty oils are lard oil, olive oil, whale oil, sunflower oil, castor oil and linseed oil. The distinction between a fatty oil and a fat (tallow, butter, etc.) is that fatty oils are liquids at room temperature (68° F.) whereas fats are solid. This difference chemically is attributable to the higher melting point of the fatty acids present in fats. As a general inclusive term for fatty oils and fats, the expression "fat" is preferable since this avoids confusion with mineral and essential oils.

★ ★ ★

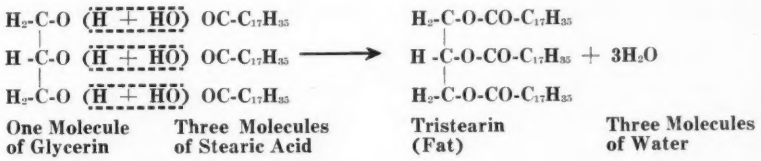
An essential oil is a volatile, odoriferous material of oily character obtained almost exclusively from vegetable sources. Like fatty materials they consist largely of the elements carbon, hydrogen and oxygen, but the arrangement of the molecules is in the form of alcohols, aldehydes, ketones etc., and not the glyceride structure characteristic of the fats. Examples of essential oils are lemon oil, oil of wintergreen, oil of turpentine and oil of lavender.

Fatty Oils and Fats

Fatty materials are distributed throughout the animal and vegetable kingdom. The vegetable oils and fats occur almost exclusively in seeds and fruits, whereas the animal fats are largely found in the tissues of the intestine and of the back. It is to be noted that although animal and vegetable oils and fats are obtained from very dissimilar sources, they form a chemically consistent group of substances that vary in body from fluid oils at low temperature to hard solids that melt at about 125° F.

★ ★ ★

As mentioned earlier, a fat is a compound formed by the chemical union of glycerin and fatty acids. The most common fatty acids are stearic $C_{17}H_{35}COOH$, palmitic $C_{15}H_{31}COOH$, and oleic $C_{17}H_{33}COOH$. The reaction involved in the synthesis of fat by a plant or animal is illustrated by the following equation:



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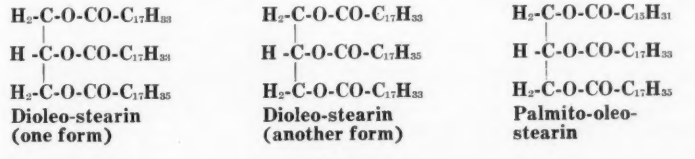
The illustration above shows the fatty acids to be represented by three molecules of stearic acid (for simplicity purposes). More normally, fats are combined with several fatty acids as shown below:



While a given fatty substance is a complex mixture of many different combinations of glycerin with fatty acids, the types and concentration of the fatty acids present remain within fairly close limits. Accordingly, it may be seen that since the glycerin portion of the fat is not subject to modification, difference in fatty materials can only be attributed to the type, concentration and molecular arrangement of the fatty acids present. It is to be noted further that the number of different types of fatty acids found in a given fatty material may range from about three to ten. Some of these acids are not combined with glycerin and are termed "free fatty acids." Now having a realization that the differences in fatty materials is explained on the basis of the fatty acids portion of the fat, we shall proceed to a study of this important group of materials.

★ ★ ★

Fatty acids present in fatty oils and fats are usually straight chain molecules ranging in size from about 4 to 30 carbon atoms. These acids are classified in related (homologous) series according to their degree of unsaturation, that is, the number of double bond linkages $>c=c<$, between carbon atoms in the molecule. The 4 principal series are sometimes referred to as the stearic, oleic, linoleic and linolenic series, which correspond

to the most important acid members of each group. The members in each of these four groups have respectively 0, 1, 2 and 3 double bonds.

★ ★ ★

It is significant to note that the melting point of the fat is higher as the size of the molecule increases in a given series. Other properties, such as the flash point, viscosity, specific gravity, etc., also follow a logical gradation in each series. This knowledge allows the chemist to predict the performance of an untested fat if certain members of the series or related series have been evaluated.

★ ★ ★

For fatty acid molecules of the same size (carbon length), a greater number of double bonds will result in a corresponding decrease in melting point. For example, stearic acid, oleic acid and linoleic acid all are 18 carbon atoms in length and differ only in that the number of double bonds in the molecule are 0, 1 and 2 respectively —but the melting points of these acids are 158° F., 57° F. and 12° F. in that order. This information explains the essential difference between tallow and lard oil, the former being largely a glyceride of stearic acid and the latter being largely a glyceride of oleic acid.

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The chemist has utilized his knowledge of the relationship between double bonds and the melting point of the fat in the development of hydrogenated fats. These materials are prepared by saturating (chemically filling) the double bonds of a natural fat by reacting with hydrogen gas. Hydrogenated fats have virtually no unsaturated linkages and have maximum melting points. It is these type fats which are often used in the manufacture of dry drawing soaps where the lubricant is subjected to conditions of unusually high temperature.

★ ★ ★

In regard to the physical and chemical characteristics of fatty acids and fats, a comparison of the more significant properties of fatty materials commonly used in drawing lubricant compositions is shown in Table 1.

★ ★ ★

All fatty oils and fats are practically insoluble in water and alcohol at room temperature (castor oil is an exception). Exclusive of castor oil, fatty materials are completely soluble in carbon tetrachloride, petroleum ether, benzene and mineral lubricating oils. Clear mixtures of castor oil and mineral oils can be prepared by the addition of tallow or lard oil to the blend.

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The viscosity of fatty materials is considerably less affected by temperature as compared with mineral oils and they have much better lubricating qualities than the latter materials.

★ ★ ★

Fats decompose above 575° F. (they do not distill) with the evolution of acrolein, a pungent odorous material derived from glycerine. Under suitable conditions fats react with water (process called "hydrolysis") and oxygen and are subject to turning rancid.

Soaps

Like the term "oils", soaps are another class of materials which have a wide divergency of meanings to the layman. In its basic conception, a soap is the reaction product of an alkali and a fatty acid. The characteristics of a soap are dependent upon (1) the type of alkali used, (2) the types of fatty acids present, and (3) other materials present in the soap.

★ ★ ★

The common alkalies used in the manufacture of drawing compounds are sodium hydroxide, potassium hydroxide, calcium hydroxide and aluminum hydroxide. Sodium and potassium soaps are water soluble whereas the calcium and aluminum soaps, often referred to as "metallic soaps," are water insoluble. Sodium hydroxide gives hard soaps and for that reason their principal use is in the manufacture of dry drawing lubricants. Potassium soaps are soft and are therefore most adaptable to the manufacture of wet drawing paste type lubricants which must readily dissolve in water. The metallic soaps are higher melting soaps than the water soluble types and are therefore generally preferred

(*Please turn to page* 1125)

TABLE NO. 1

PROPERTIES OF FATTY OILS AND FATS

Name	Type	Specific Gravity	Flash Point Min. °F.	Iodine Number	Saponification Number	Free Fatty Acids, %	Pour Point, °F	Viscosity S.U.S. 100°F.	Viscosity S.U.S. 212°F.
Castor Oil	Nondrying	0.960-0.970	530	82 - 92	176-187	0 - 6	0-10	1200	95
Lard Oil	Nondrying	0.910-0.919	500	68 - 72	190-198	1 - 25	32-60	210	51
Neatsfoot Oil	Nondrying	0.912-0.918	470	65 - 75	190-202	0 - 20	10-50	210	51
Sperm Oil	Nondrying	0.878-0 882	455	80 - 95	120-140	0 - 3	30-35	100	38
Tallow	Nondrying	0.915-0.940	550	34 - 58	190-198	1 - 10	100-125		55
Palm Oil	Nondrying	0.992-0.925	450	50 - 56	196-202	10 - 60	80-110	221	56

Twisted Paper's Role in the Wire Industry

by W. Garwood Bacon, Jr.
Sales Manager
Rug and Electrical Division
E. W. Twitchell, Inc.
Philadelphia, Pa.

To the average consumer paper is Saturday morning's grocery bag, last week's letter from Mother, and the reason for having a waste basket in every room. Unfortunately, these consumer experiences result in the misbelief that paper is a useful but disposable substance.

★ ★ ★

On the other hand, as far back as August 9, 1881, when James Walter Perkins, Toms River, N. J. filed application for a patent on paper twine converting, there were men of vision changing paper into twisted form for specific industrial applications.

★ ★ ★

Large volume industrial applications have been developed in the past 25 years for paper in yarn, cordage and woven form. With the use of special machinery after twisting, the products can assume triangular, rectangular, and half-oval shapes. Additionally, it can be dyed before or after converting and can be saturated or treated with almost any chemical or agent that will mix with or be suspended in water.

★ ★ ★

Special characteristics of hardness or softness, moisture, fungus or flameproofness can be achieved in this manner. High wet strength properties are obtainable by adding melamine formaldehyde or urea formaldehyde resins in the pulp mixture before the sheet is formed.

★ ★ ★

Very few of us thoroughly appreciate the durability of paper. Do you know that iron deteriorates six times faster than paper? The deterioration rate of paper is only ½ of 1% per year, whereas iron's rate is 3%.

The author attended Temple and Pennsylvania Universities. He joined the Twitchell organization in 1938 and, except for a period of service with the Navy from 1941 to 1945, has been with the company continuously. His paper, prepared for presentation at the Annual Convention of The Wire Association in Chicago on November 10th, 1953, discusses the applications of paper in the manufacture of insulated wire and wire rope.

Electrical Applications

The electrical industry has always used large quantities of paper for insulating purposes. Its early use of twisted paper yarns for braiding and wrapping applications has contributed immeasurably to the development of the paper converting industry. Chart #1 describes some cable which was taken from a Philadelphia house in 1947 for the purpose of exhibiting the remarkable stability of paper yarn in cables over 20 years old.

W. Garwood Bacon, Jr. * * *

Over the past thirty years a number of commercial applications have developed. Listed are two typical examples:

(a) Wardwell and New England Butt Braiders utilize .020 to .028 diameter yarns in manufacturing automotive hardness assembles.

(b) Circular looms use larger yarns from .050 to .125 diameter in processing tubular sleeving.

★ ★ ★

Approximately, in 1930 twisted paper was introduced as a filler in Paper Insulated Power Cable. The cable manufacturers were instrumental in helping to establish rigid specifications on the basic paper. Requirements were set up on the paper for control of the alkaline and acid content, Ph factor and removal of all metallic or other matter of a dielectric resistance nature.

★ ★ ★

In 1936 a slack twisted paper filler, impregnated with paraffin oil was introduced in three wire non-metallic sheathed cable. (Fig. No. 1.) To prevent a leaching problem the saturant was changed to a highly refined paraffin wax with less than 1% oil content. Its phenomenal volume growth and acceptance into both two and three wire constructions has been recently enhanced by the entrance of several paper converters into this field, thereby increasing domestic supply. Newly developed Fiberglas reinforced paper fillers can provide sufficient strength for two wire and fill the interstice completely for improved moisture tests.

★ ★ ★

Due to the shortage of imported

CHART #1

Aging of paper in Cables

A. Sample	#1	#II
B. Description	Two-wire house cable	Two-wire house cable
C. Construction	Copper conductors, rubber ins. comb. of paper & cotton braid, folded paper wrap, asphalt com.	Copper conductors, rubber ins. Cotton braid on individual cond. Comb. paper & cotton overall jacket, asphalt com.
D. Source	Lead pipe leading into house being demolished at 1069 Germantown Ave Phila., Pa.	Third floor ceiling at house at 1069 Germantown Ave. Phila., Pa.
E. Installation	1940	1926
F. Authority	Sadie Pitcock, 1073 Germantown Ave.-Owner	(1) Sadie Pitcock, 1073 Germantown Ave. (2) D. Feldman, Belmont Salvage (3) Wm.. Pesy-lived adjacent house, similar construction since 1923.
G. Removal C	October 24, 1947	October 24, 1947
Initial Exam.	No visible deterioration of components.	Asphalt dry and cracked. Paper yarn dry, but no evidence of decomposition.
H. Current Exam.	April 27, 1953	April 27, 1953
Comments	No visible change. Paper has excellent aging properties.	No visible change. Paper has excellent aging properties.

coarse fibers during World War II wax impregnated paper fillers were used in Maritime Shipboard Cable as a temporary expedient. However, the 1945 AIEE specification inadvertently reverted to prewar practice and Section 18.13 on fillers read "Use saturated jute unless otherwise specified."

★ ★ ★

Since the same paper filler can be used interchangeably in non-metallic or maritime shipboard cable several cable manufacturers were interested in having it approved. The AIEE Committee recognized the desirability of permitting the use of domestic materials such as paper, synthetic rubber, etc. and the 1948 AIEE specification included a change in filler description whereby any suitable material may be used that meets the tests on the completed cable.

★ ★ ★

The Portable Cord Development (Fig. No. 2) has been slower to reach volume proportions in view of the fact that it has been necessary to achieve a filler which is contrary to paper's normal characteristics; that is, something that is exceptionally strong, yet soft and pliable. This was accomplished by introducing Fiberglas as a reinforcing member in the center of a creped Kraft paper. These have been designed to meet the Underwriter's tensile strength specifications for S, SV and SJ Cords. These fillers provide a smooth surface for plastic or rubber jacket, and being utilized one end per valley affords faster and cleaner stripping.

★ ★ ★

About eight out of every ten miles of aerial power cable is ACSR. Initial trials with twisted paper as an expander between the steel core and the outer aluminum conductors date back to 1937. Interrupted by the war, work was begun in earnest in 1945 in both the United States and Canada. After many years of research, experimentation and development, paper cordage is successfully treated to withstand fungus attack. One process involves a coal tar impreg-

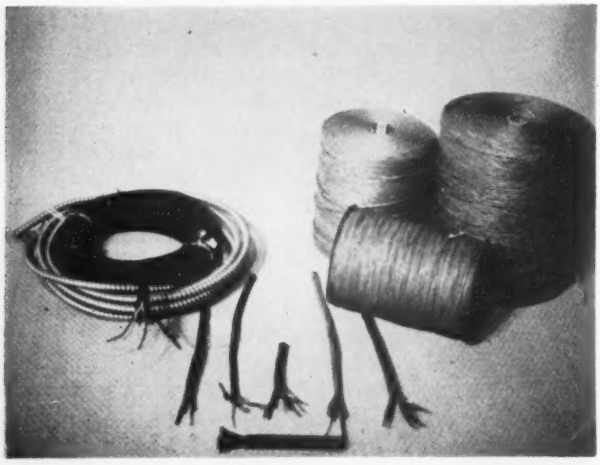

Figure 1.

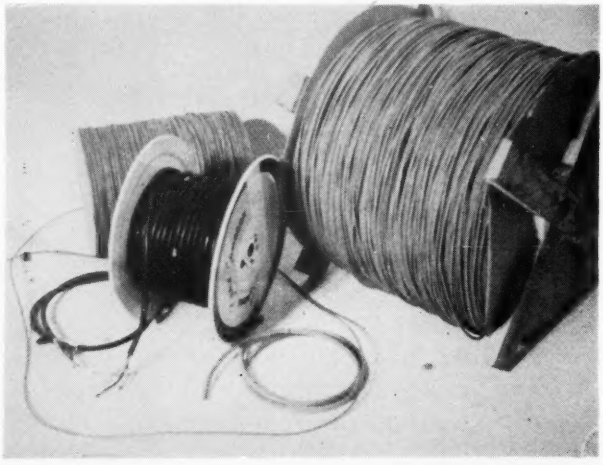

Figure 2.

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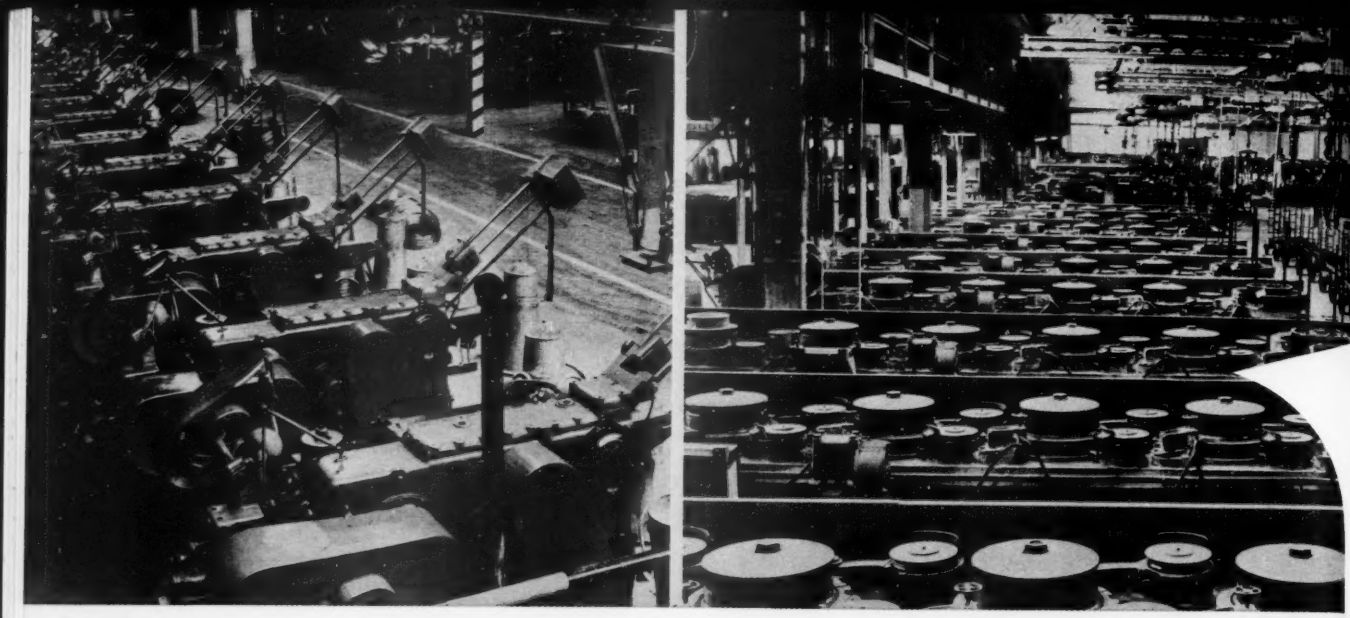
*For example



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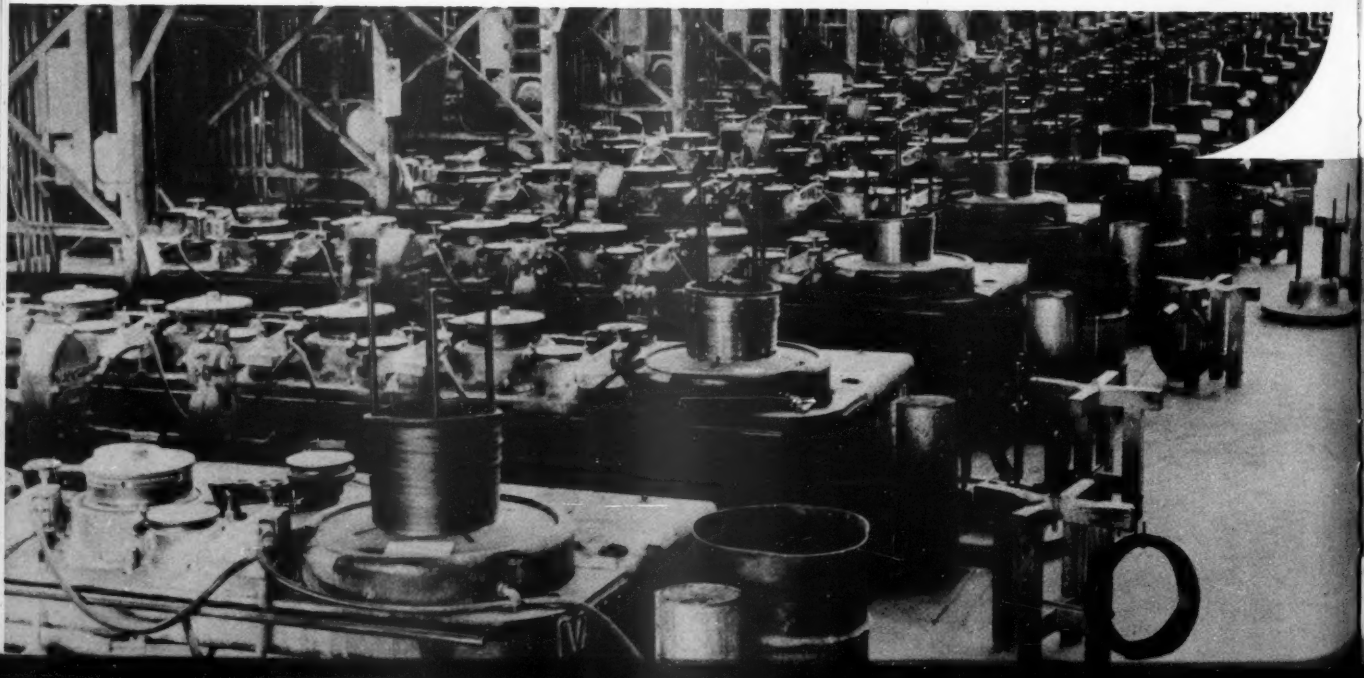

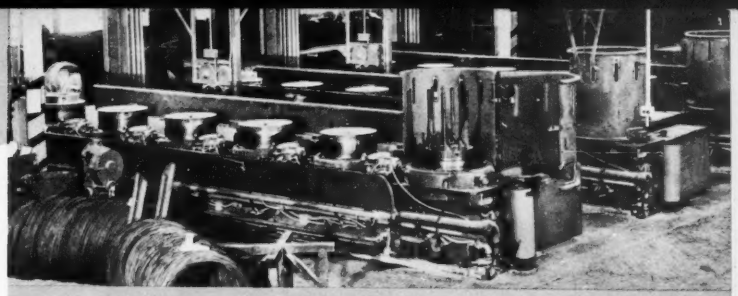

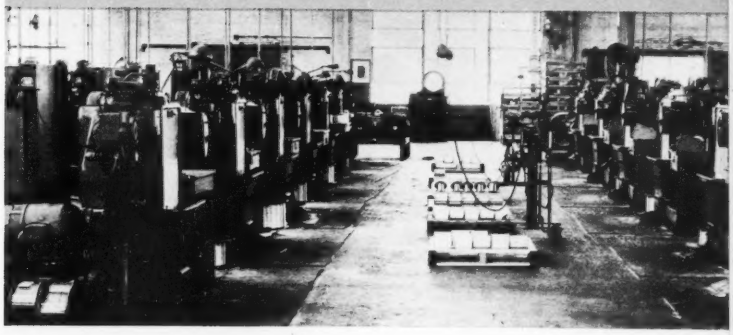

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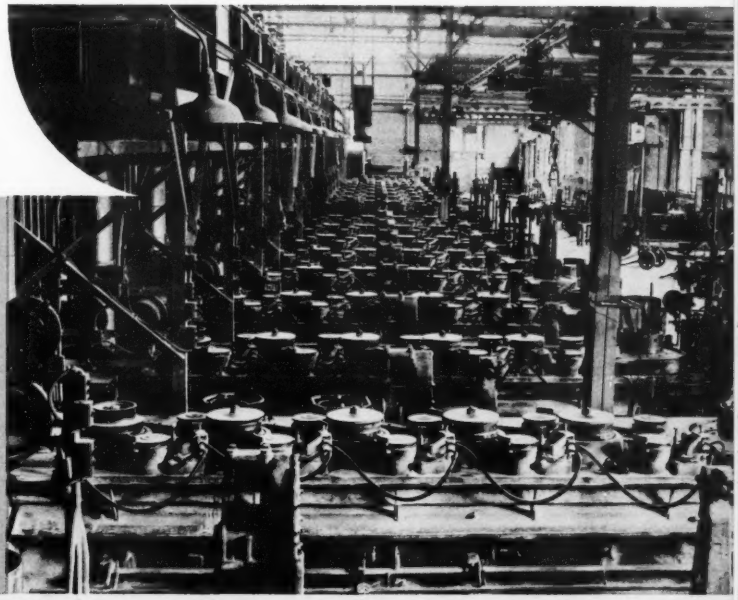
VAUGHN BOX SCORE

at Colorado Fuel and Iron

TYPE	PUEBLO	ROEBLING	WICKWIRE SPENCER	CALIFORNIA WIRE CLOTH
Wire Drawing Machines	32	162	84	16
Auxiliary Machines	29	120	62	9
TOTAL	61	282	146	25

total 514



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THE VAUGHN MACHINERY COMPANY
CUYAHOGA FALLS, OHIO, U. S. A.

COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys

nant, and commercial application has now been realized in expanded ACSR cable. (Fig. No. 3.) These

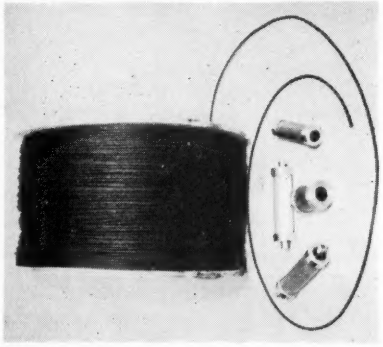

Figure 3. * * * * * * * *

fungusproof fillers expand the cable diameter to take advantage of the skin effect. The aluminum conductors are concentrated on the periphery permitting much greater power carrying capacities than ever achieved in the past. The light weight, durable paper expanders have a controlled saturation which serves the dual purpose of proper forming die lubrication and providing an impervious barrier to fungus spore.

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Endless length reels, containing 80 to 100 lbs. of paper cordage have been developed for this market. Chart #2 refers to spore types and negative results achieved.

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Another impending application is fungusproof paper roving for bedding and overall serving as protective sheathing for Underground Lead Sheathed Cables. Paper roving offers excellent abrasion resistance and a low cost domestic supply. Paper is a purer cellulose material, and soil immersion tests have indicated a slow rate of deterioration. Cables constructed with paper roving overall serving have withstood almost one year's exposure to outdoor weathering conditions entirely unprotected. Exceptionally adverse conditions were arranged in simulated plowing proving beyond a doubt its practical application under all circumstances.

Wire Rope Applications

In 1947 another development occurred. A one-ply waxed impregnated paper core was utilized in wire ropes of sash and tiller types.

(*Please turn to page* 1142)

CHART #2

Fungus Resistance (of Tar Treated Twisted Paper)

A.	Cord	.170 Hard Twisted Tar Treated Paper Cord, from 100% sulphate Kraft paper.	
B.	Impregnant Description	15-20% Medium soft coal tar pitch 80-85% Anthracine Oil	
C.	Length of Study after inoculation	Eight Weeks	
D.	Mold types & results	Penicillium Lateum	Negative
		Fusarium	"
		Trichoderma	"
		Mucor Mucoides	"
		Aspergillus Nidulans	"
		Aspergillus Flavus	"
		Aspergillus Niger	"
Comments:		Excellent resistance to fungus attack. A similar test was conducted with a special pine tar treatment with negative results.	

CHART #3

Bending Fatigue Resistance of Treated Paper Cores

A. Sample	#1	#2	
B. Wire Rope	1/2" 6/19 R. L.	1/2" 6/19 R. L.	
C. Core Type	Waxed treated paper	Hard Fibre	
D. Reversals Before Failure	12,536	12,527	
Comments:	Wax treated paper is a satisfactory alternate for hard fibre.		

A.	COMPANY B #1	#2	#3
B. Wire Rope description	3/8"	3/8"	3/8"
C. Core Type	Waxed treated paper	Tar Sat. paper	Hard Fibre
D. Reversals Before Failure	15,407	16,122	17,246
Comments:	Waxed or tar treated paper are satisfactory alternates for Hard Fibres. Both exceeded fatigue life test specification.		

The Sheathing of Cables With Aluminum

by Kenneth S. Wyatt, Cable Engineer
Phelps Dodge Copper Products Company
New York, New York

Introductory

Lead, after half a century as the prime cable sheathing material and with a background of several thousand years of service as water piping, at last faces a serious competitor—Aluminum. Already the British have made more than 3,500 miles of aluminum-sheathed cable, the Germans perhaps 500 miles, while in North America there are more than 100 miles. Abroad and at home new methods and machines are being developed for the application of aluminum cable sheathing. The subject is frequently referred to in current technical journals. The question is: How far will this revolution go and how fast will it take place?

Historical

The earliest use of aluminum sheathing known to the writer was for 8,000 feet of telephone cable for the dirigible "Akron" and 8,000 feet for the "Macon" in 1932. Both were produced by ALCOA by the tube reducing method, i.e., the cable is threaded into an aluminum tube which is then rolled down to fit the cable snugly. Later, in 1938-44, the Oberspree Cable Works in Germany manufactured test lengths of aluminum-sheathed power cables from 1 to 50 Kv. Siemens and other German manufacturers are known to have also produced aluminum-sheathed communication and power cables commercially in small amounts before the war.

After a long and distinguished career as an expert on high voltage cables, the author joined Phelps Dodge in 1940 as Engineer of Cables. During the period of the war he devoted his attention to the development of polyethylene radar cables, of which his company became one of the leading producers. Following the war, he again concentrated on high pressure, extra-high voltage cables, simplifying and improving previous designs. The company, largely as a result of his efforts, is presently a leader in the pipe cable field at the highest voltages.

This paper is based on a talk presented by Mr. Wyatt before the Lead Industries Association at White Sulphur Springs on April 10, 1953. In it a new process of sheathing cable with aluminum is discussed.

* * *

Large scale manufacture, however, did not take place until 1946 when the shortage and high price of lead, and to some extent of labor, led Johnson & Phillips in England to introduce the "draw-down" method. In this the cable core is threaded into a seamless aluminum tube of 10% greater diameter, the core and tube being then drawn through a die which "sinks" the aluminum tube closely onto the cable. To date over 4,000 miles of cable, both paper and rubber-insulated, have been sheathed by this process, and this cable is in service in many parts of the British Empire. Particular success was met with in industrial cables where normally iron-conduit would be used, into which cable would be later pulled and jointed; here the great saving of labor was the impetus and not the scarcity and high price of lead. The phenomenal success of Johnson & Phillips is leading other British cable makers to get actively into aluminum cable sheathing, either by the "draw-down" method or

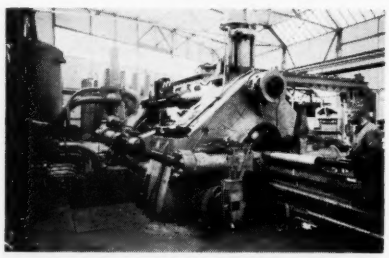

Fig. 2—2500 ton Schloeman press extruding 3¼" aluminum tubing in continuous lengths. A 1000 ft. length requires about ten billets each 176 lbs. (Courtesy Felten & Guilleaume, Cologne.) *

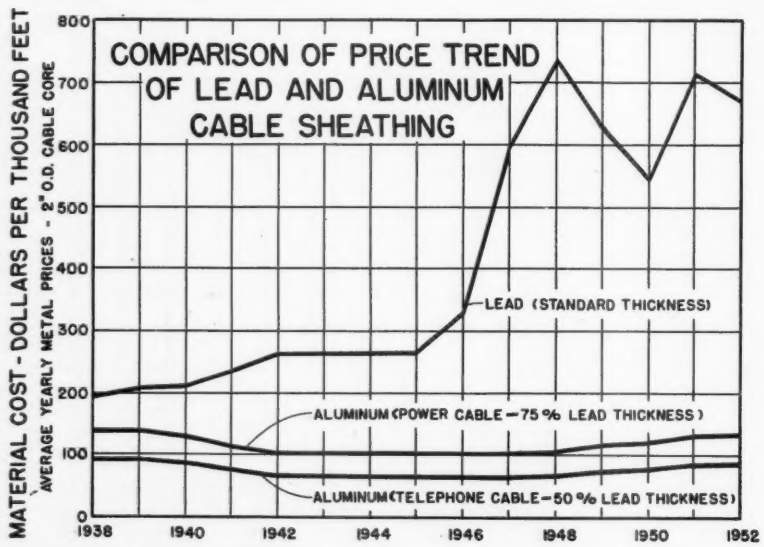

Fig. 1—Comparison of Price Trends of Lead and Aluminum Cable Sheathing. * * * *

by hot extrusion. The British Standards Association is expected to issue specifications for aluminum cable sheathing before 1954.

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Both before, during, and after the war the Germans had been developing presses and techniques for hot-extruding aluminum sheath **continuously** onto cables, but the difficulties were almost insurmountable. In 1949 Felten and Guilleaume adopted a form of the Johnson & Phillips "draw-down" method. The aluminum tube is laid out straight in a gallery several thousand feet long originally used for pre-stretching steel wire rope, the cable core is pulled in, and then a die travels along the cable sinking on the sheath. Whereas Johnson & Phillips had confined themselves chiefly to small cable diameters, usually 1 to 1½ inches, and to relatively short lengths (300 to 500 feet), F & G made lengths of 1,000 feet, and in 1 inch sizes, of 1,600 feet; and diameters as great as 6⅛ inches. In this way they sheathed over 200 installations of coaxial Styroflex Cable, and many telephone cables over the Rhine bridges where vibration difficulties made aluminum especially desirable. F & G had mastered the technique of joining billet to billet without mechanical weakness at the junction. Both very pure aluminum (99.-99%) and commercial grades (99.4%) were used, depending on the application. The drawn-down method is looked on purely as an interim method to take care of production until an 8,000 ton extrusion press is shortly installed.

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In the United States little or no progress was made until 1952, despite the early start with the "Akron" cables in 1932. Five thousand feet of 11 pair No. 19 telephone cables sheathed by the tube reducer method were installed by ALCOA in their Point Comfort plant in 1950, but this was ½ to ¾ inch in diameter and in lengths of 100 feet or less. The Bell Telephone Laboratories had installed perhaps one quarter mile of aerial telephone cable with aluminum sheath at Chester, New Jersey, for experimental purposes. Then in December 1951, Phelps Dodge Copper Products Corp. decided to go into the manufacture of aluminum-sheathed high frequency coaxial cable and power cables under license from Felten and Guilleaume of Cologne, Germany, the decision being announced in the press January 15, 1952. (Two days later, January 17, 1952, British-Insulated Callender's Cables and Loewy's Engineering Co., Ltd., of England, announced the formation of Alsheath, Ltd. to develop the extrusion process.) Phelps Dodge at this time took an order from the Atomic Energy Commission, through their sub-contractors, the Naval Research Laboratory, for 200,000 feet of 3⅛ inch and 100,-000 feet of ⅞ inch aluminum-sheathed coaxial cable. In this cable the sheath is also the outer conductor, and only a metal of high electrical conductivity could be used, hence there was in this instance no displacing of lead by

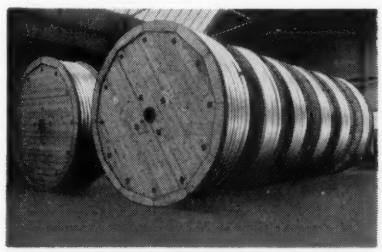

Fig. 3—Reels of 3⅛" diameter aluminum sheathed coaxial cable awaiting shipment to Las Vegas, Nevada, for the Atomic Energy Commission. The sheathing with aluminum of 1000 foot lengths of this large diameter is regarded as a remarkable achievement. (Courtesy of Felten & Guilleaume, Cologne.)

aluminum. Since six months was required to get into production here, the cable was made by Felten and Guilleaume in Cologne and shipped to the USA in 1,000 foot lengths. The first deliveries of this unusually long-length, large diameter cable arrived here in early February 1952. The installation of this cable at Las Vegas demonstrated beyond doubt that large diameter aluminum sheath cables could be reeled and unreeled and handled satisfactorily in the field, that billet to billet junctions did not introduce weakness, and indeed that long lengths of such large diameter aluminum sheath cable could be manufactured uniformly. Since then several hundred thousand feet of Styroflex Cables have been supplied, most of it manufactured by Phelps Dodge at their Yonkers, N. Y. plant.

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The most recent achievement by Felten and Guilleaume is the installation of aluminum-sheathed coaxial television cable 6⅛ inch diameter on the Eiffel Tower in Paris. This is about 1,000 feet in height. When it is recalled that a thousand foot length of 3⅛ inch cable requires nearly 10 billets, and that even a 500 foot length

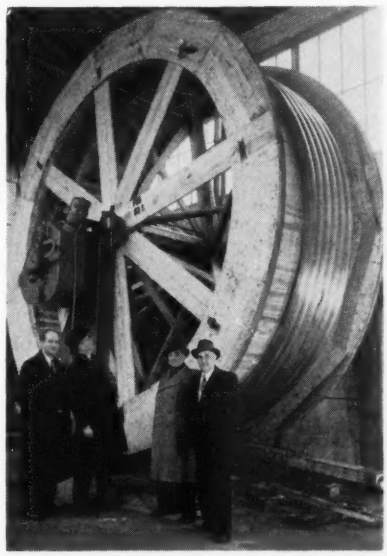

Fig. 4—Test length of 6-⅛" aluminum sheathed coaxial television cable for the Eiffel Tower, Paris. The cable was made in Cologne and shipped to Paris on a 20 ft. diameter reel. (Courtesy of Felten & Guilleaume, Cologne.)

Fig. 5—The cable at the base of the Eiffel Tower is ready for installation. About 1000 feet of cable was required. It is estimated that 500 feet of this 6-⅛" cable would require between 30 and 40 aluminum billets. (Courtesy of Felten & Guilleaume, Cologne.)

of 6⅛ inch cable with its thicker wall would require several times this number, and when it is recalled that the British have not

Fig. 6—The 6⅛" aluminum-sheathed Styroflex television cable installed on the Eiffel Tower. This precision-type cable had to be used in order to preserve the high definition of the French 819 lines-to-the-inch system (ours is 525). (Courtesy of Felten and Guilleaume, Cologne.) * * *

yet learned the secret of joining billet to billet without gas inclusions (28) and have to rely on large billets and large presses which give only limited lengths, the accomplishment of the Eiffel Tower cable hits one with greater force. It is the writer's opinion that the Germans, in particular Felten and Guilleaume, are considerably ahead of the British in this field technically, although it must not be forgotten that the British pioneered the draw-down method and in quantity of aluminum-sheathed cables already produced they far outstrip the Germans. The Felten and Guilleaume cable examined here has shown a high degree of precision, for example, the outside diameter of the 3⅛ inch cable in 1,000 foot lengths for Las Vegas was correct within about five one-thousands of an inch. This is discussed in a U. S. Government Report by James Ambrose and G. Dinnick of the Naval Research Laboratory in Washington.

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Phelps Dodge is also manufacturing aluminum-sheathed power cables, 4,000 feet—3-conductor—15 Kv. aerial cable for Boston Edison, 200 feet—3-conductor—13.8 Kv. cable for Commonwealth Edison of Chicago, and 15,000 feet of 1-conductor—27 Kv. duct cable for Consolidated Edison Co. of N. Y. All three cables will have a polyethylene jacket over the aluminum as corrosion protection.

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The Canada Wire & Cable Co. of Toronto, under license from Johnson & Phillips, are making aluminum-sheathed power cables. One installation for the Quebec Hydro Commission at Montreal, consisting of 15,000 feet of 1-conductor—120 Kv. Pirelli-type oil-filled cable in ducts has been in operation for 8 months. Another installation by the British Columbia Electric Railway Co. of Vancouver consists of 54,000 feet of 69 Kv. single conductor cable, three cables being pulled into one duct. They are also manufacturing 4,500 feet of 300 Kv. oil-filled cable with aluminum sheath for the Aluminum Co. of Canada at Kittimat. In all cases the aluminum sheath is protected by a "rubber sandwich" jacket. In the extension of their Leaside plant, Canada Wire & Cable used aluminum-sheathed-3-conductor—12 Kv. cable for supplying power. The cable was suspended on racks. Although the spacing of the latter was rather great, the cable did not show undue sag.

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The British-Insulated Callender's Cable Company, of London, have sheathed several hundred miles of cable by the draw-down method. Some of this was coaxial cable for community aerial systems in Montreal, Canada. They are looking ahead to hot-extrusion in the future.

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From this brief resume it will be seen that aluminum sheathing for cables is already well established and growing rapidly in Great Britain, on the Continent it is less well established, and in North America it is making a successful beginning.

The Relative Merits of Lead vs. Aluminum for Cable Sheathing

A glance at the table of properties of the two metals makes it obvious that aluminum is not just a substitute for lead.

TABLE I

		Lead	Aluminum
specific weight	g/cm^3	11,4	2,7
electrical conductivity	$m/ohm.mm^2$	4,7	greater than 33
vibration factor	$.10^6$	1,5-2	greater than 50
hardness	kg/mm^2	3,5-4	25 - 30
tensile strength	kg/mm^2	1,7	8 - 10
elongation	%	40-25	25 - 15

Aluminum is much lighter than lead (less than ¼) making it easier to handle and cheaper to ship, with very great advantage for telephone or power aerial cable. It is much stronger (6 times) and harder (7 times), making it ideal for cables with internal pressure since no re-enforcement is necessary; this applies also to buried cables where the steel tape re-enforcement required with lead may be omitted. Its higher resistance to vibration fatigue (25 times) makes it very desirable for bridge cables and for aerial cables. Its greater electrical conductivity (7 times that of lead), makes it excellent for coaxial cable sheathing.

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Lead, on the other hand, is easy to join, patch or repair, aluminum more difficult. (If the aluminum is first "tinned" with an alloy of 40% cadmium—60% zinc, it can be wiped to a lead or copper sleeve in the usual manner; the Johnson & Phillips use of 90% tin—10% zinc is not recommended because of corrosion at the interface. Even so, such wipes if installed in wet manholes must be protected with moisture proof wrappings and an inhibitor, e.g., dichromate paste,

spread over the junction; in moist places inspection every year or two is mandatory.) Lead is not as susceptible to corrosion as aluminum, although both should be protected with a jacket for bad electrolytic or other conditions. However, aluminum of ordinary EC grade has been widely used throughout the United States for transmission lines for more than 20 years without any corrosion trouble whatever, excepting near the sea, hence it should be suitable for aerial cable sheathing. Lead is far easier to form around the cable than aluminum. Lead bends and reels more easily than aluminum.

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While the writer has never been able to see any particularly good reason for aluminum conductors in insulated power cable, except wartime shortages or national necessity, the use of aluminum for cable sheathing has always appeared a "natural." The question then arises as to why aluminum was not used for sheathing before. The answer of course lies in the extreme difficulty of extruding aluminum around a cable, both because the high temperature necessary (520 C) causes the cable insulation to melt or charr, and causes troubles with the steel of the press, and because it is difficult to unite billet to billet as is necessary in a continuous operation, and because pressures are high, and porosity of the sheath difficult to avoid. These difficulties have now been overcome.

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Of all these difficulties with aluminum there are only two of consequence, corrosion and joining. There is now over 10 years experience with plastic strip protection of aluminum sheath in Germany and Dorfel (27) states that such cables are no more prone to corrosion than lead. The fact remains that all aluminum-sheathed cables for use underground must be given corrosion protection; lead for buried service is also protected, but for ducts is usually left unprotected. Joining is more difficult with aluminum but is no longer a problem.

Methods of Applying Aluminum Sheath

Aluminum sheath may be formed on the cable in three ways: the "draw-down" method, hot-extrusion, or the strip process. The "draw-down" method consists in sinking an oversize aluminum tube snugly onto the cable. (We prefer the term "draw-down" to that sometimes used abroad, "die-down.") Either the tube and core are drawn through a die, or the die is drawn along the tube containing the core. This method is the only one used to any extent so far in the sheathing of cables. It was worked out by the British and is an achievement. It is a discontinuous method; since most cable makers purchase their aluminum tubing outside, it frequently leaves them without full control. The writer believes the "draw-down" method is purely an interim method which will be replaced eventually by the hot-extrusion and strip methods.

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The hot extrusion of aluminum sheathing directly onto the cable continuously has been for long years the ultimate goal of German engineers, but the high temperature (520 C) necessary for the aluminum affected both the steel of the press and the insulation of the cable core. After a number of small presses had been built and tried out in Germany and in England, several large presses employing different principles have been constructed and are now being installed. Some of these should prove successful. The largest is that of Felten and Guilleaume with 9,000 tons capacity. It will extrude sheath up to 7″ diameter. It is now undergoing trials prior to use in commercial production. Such a press, installed, would cost in this country over one million dollars, and overhead would require that it constantly be **fed** with large quantities of cables. Cable manufacturers in England and Germany having such machines will thus be forced to actively develop markets for aluminum-sheathed cables throughout the world. The F & G press can extrude a 10 mil wall uniformly and without porosity onto a low-melting point polyethylene core and the latter may be left in the press for half an hour without damage. It would not of course be economical to use such a large press for very small cables. The press can be used also for extruding aluminum wire bars, 4 or more at a time, and it is said it will be cheaper than rolling.

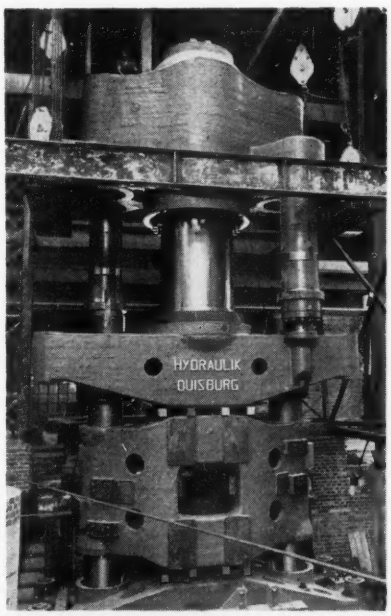

Fig. 7—The 8800 ton aluminum press for direct extrusion of aluminum sheathing onto the cable being installed. It can handle cables up to 7″ diameter, and aluminum down to 99.4% purity. (Courtesy of Felten & Guilleaume, Cologne.)

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Direct extrusion of the sheath will make possible three important economies in coaxial cable: (1) the large amount of labor involved in shipping, unreeling and straightening out the aluminum pipe, threading in the cable, and drawing-down the pipe onto the cable will be eliminated; (2) once the rigorous treatment which the draw-down method involves is done away with, thinner walled aluminum sheath can be used; (3) the pitch of the helix can be increased so that the cable will be adequate mechanically and improved electrically.

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The strip method consists in forming a strip of aluminum around the cable with forming rolls, and then welding the longitudinal seam by high-frequency induction under argon atmosphere.

Subsequent to the welding the sheath is reduced slightly by finishing rolls to tightly fit the cable. The best method appears to be that of the Yoder Roller Co. of Cleveland. Their cable machine is

Fig. 8—The Yoder Machine for making aluminum tubes from strip from ¾" to 4" OD. With wall thicknesses from 0.025" to 0.134" at speeds of 40 to 120 feet per minute. The strip is formed by rolls to a circular shape and the seam welded by high frequency induction under argon atmosphere, after which additional rolls reduced it to exact size. A similar machine is under development for telephone cable sheathing. Kaiser Aluminum, Bridgeport Brass and Alcoa have the above type of machine in commercial operation.

not yet ready for commercial production, although their machine for making aluminum piping is. Cable sheathing is applied at rates up to 120 feet a minute. The weld is at least as strong as the rest of the sheath. A ridge is left inside which, however, would be harmful in high voltage cables. While the method is satisfactory for tubes because the latter can be subsequently tested for porosity, it is less satisfactory for power cables because of the impossibility of testing. With telephone cable, however, it is different, because there is space between the insulated wires under the sheath for gas to flow readily, hence testing the seam with dry air under pressure is now being tried out. For some types of cables, e.g., rubber-insulated cables, occasional porosity at the seam in the aluminum sheath would not be of consequence.

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A similar method has been developed in England by Pirelli-General of Southhampton. Its speed of 5 feet per minute is relatively slow.

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A recent variation in the strip method is to give the aluminum strip a zinc dip and a thin copper plating on both sides. Then the standard Yoder machine which solders the longitudinal seam may be used, and the bugbear of seam porosity is eliminated. But interfacial corrosion between the copper and aluminum where the cable is used outdoors makes this solution doubtful.

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The cost of aluminum billets for the extrusion machine is 21 cents per pound, of aluminum strip 33 cents per pound, and of aluminum tubing 45 cents per pound.

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When the Yoder strip process is perfected the machine, because of its low capital cost and high output, should be useful in supplementing a heavy press in sheathing small rubber or plastic cables, leaving the press for heavy work.

Economics

Since aluminum is less than ¼ the weight of lead, it follows that the price of lead must be about ¼ the price of aluminum if the same thickness is used, or ⅛ the price of aluminum if ½ thickness is used as in telephone cable, if the two metals are to be economically equivalent, disregarding the cost of application. For telephone cables, to match aluminum at 20 cents per pound lead would have to sell for 2½ cents per pound. In power cables the thickness employed for aluminum sheathing is only 70 to 90 percent that of lead, hence at 75 percent thickness lead would have to sell for 4 cents per pound to be economically equivalent. (See Fig. 1).

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These statements are an oversimplification but give a sound general picture. Some modification must be made for the cost of the corrosion protection on the aluminum but as it is fairly cheap, and as it would be an advantage to also use it with lead sheath, we have neglected it. Application costs for extruded aluminum sheaths should run higher than for lead. Lead has a slight disadvantage in freight and in labor of handling.

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The comparison may be made in another way. The material cost for the sheath of 1 foot of 1 inch diameter telephone cable is, for lead at 1951 prices, 22 cents; for stalpeth, 12 cents; and for aluminum, 2 cents.

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For power cable, 1 foot long and 2 inches diameter, 13 cent lead would cost 51 cents a foot, 21 cent aluminum of 75% thickness would cost 14½ cents.

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For high pressure power cables the saving due to aluminum would be much greater because the reenforcement can be omitted.

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There seems little doubt of the economic advantage of aluminum for cable sheathing.

Availability of Aluminum

Lead at the present time is in ample supply, and aluminum should also be in ample supply in the near future.

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Primary aluminum production in the United States has been and is expected to be:

1951—1,680,000,000 lbs.
1952—1,870,000,000 lbs.
1953—2,700,000,000 lbs., estimated
1954—3,400,000,000 lbs., estimated

★ ★ ★

Total aluminum available for manufacture, including primary, imports and secondary:

1952—2,400,000,000 lbs.
1953—3,500,000,000 lbs., estimated

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In the face of these figures and the obvious deductions therefrom, it is difficult to see any change in the differential that would be importantly favorable to lead in competition for cable sheathing.

Will Aluminum Cut Into the Consumption of Lead for Cable Sheathing?

It has already been seen that technically and economically aluminum is in a favorable position. Let us attempt an analysis.

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Telephone Cable—If stalpeth sheath had not been introduced, 125,000 tons of lead would have been used this year. As it is, 30,000 to 40,000 tons less of lead will be used because of the stal-

peth sheath. When the aluminum sheath technique is worked out, it would appear that the 12 cent stalpeth sheath which nosed out the 22 cent lead sheath will itself be eliminated by the 2 cent aluminum sheath. It would not be surprising to see lead, commencing in about 2 years' time, gradually lose out completely to aluminum in this field. In the meantime, it is losing out to stalpeth.

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Coaxial Cables—Lead never has been generally used in this application. Aluminum sheathing is replacing copper piping, and should become almost universal in this field. Aluminum sheathing and aluminum alloy (Aldrey) armor have made it possible to design a hollow core (and therefore highly efficient electrically) coaxial cable for deep sea telephone and radar frequency uses and this development should be of great importance in the communications field (Figs. 9 & 10). For the high pressures encountered, up to 5 tons psi, the insulating spacer must be very strong and hence Styroflex was selected which is actually harder than aluminum (Fig. 11).

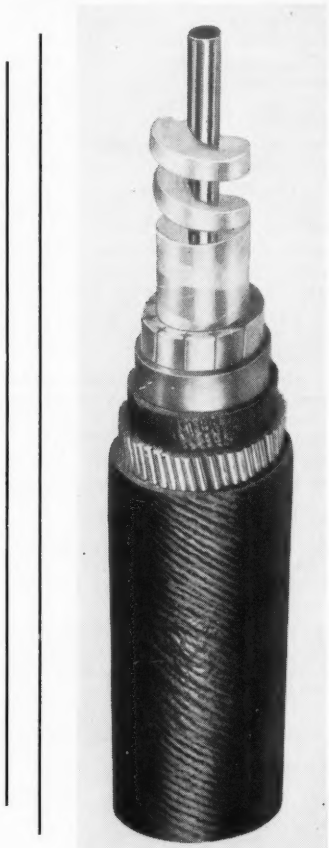

Fig. 9—The Deep Sea Styroflex Cable (coaxial) in which aluminum alloy armoring and aluminum sheath make practicable for the first time a substantially air-core cable for the deepest ocean. The high efficiency of the air-core construction for frequencies up to 5000 megacycles giving a smooth attenuation vs. frequency curve makes possible undersea telephone for several hundred miles without repeaters, i.e., with practically 100% reliability; and on transatlantic telephone circuits the elimination of 1/2 to 2/3 the number of repeaters required with solid polyethylene cable; and brings nearer transatlantic television. The cable has passed hydraulic tests up to nine tons psi pressure. (Courtesy of Felten & Guilleaume, Cologne.) * * * * * *

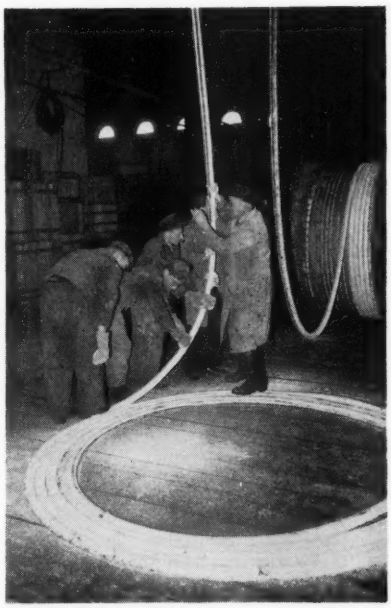

Fig. 10—The Deep Sea Styroflex Cable, despite aluminum armor and sheath, passes easily over the standard pay-out shieve and coils readily. A non-reflecting plug is cast into the cable at 1000 feet intervals. Because of two layers of armor with reverse lay, the cable is "dead", i.e., has no tendency to spin. Hence cable will not break off at junctions with repeaters and the cutting-in of improved repeaters in later years becomes practicable. (Courtesy Felten & Guilleaume, Cologne.)

Power Cables—For **industrial cables,** for example, wiring and control cables, aluminum-sheathed cables have been in great demand abroad and may in time replace other types fairly completely because of the saving of labor and the neat appearance. Since lead is little used in this application, the gain for aluminum will not be at the expense of lead.

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In aerial cables aluminum may be expected gradually to replace lead almost completely because of its light weight, and high resistance to vibration fatigue.

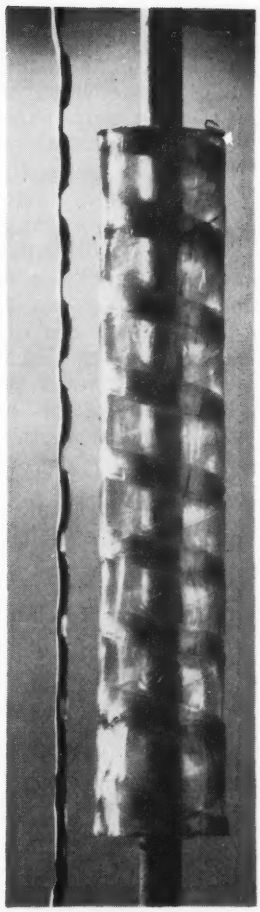

Fig. 11—DEMOSTRATION OF THE EXTREME HARDNESS AND LACK OF FLOW CHARACTERISTICS OF STYROFLEX.

An accident, which beautifully illustrates the hardness and lack of cold flow of the Styroflex helix, is shown in this photograph. Between the armor and the helix of an experimental Styroflex Cable, which was later subjected to pressure tests at 9 tons per sq. in., a piece of soft aluminum wire fell in. When the cable was examined after the hydraulic tests, the wire was discovered. It was not, as one might expect, the Styroflex helix which was damaged, but instead the aluminum wire! The picture shows the indentations of the Styroflex helix in the aluminum wire and these indentations are fairly sharp. The helix itself was not damaged at all. This indicates that the Styroflex is much harder than the aluminum.

Up to this time in communication cables we have been dealing chiefly with insulating materials of a marshmallow-like nature which have considerable cold flow under conditions of service and, therefore, the cables in which they are used don't have permanence and unchanging characteristics over long periods of service. The introduction of the Styroflex helix with its rock-like characteristics, as different from the other class of insulating materials as day is from night, provides us with a means of obtaining a coaxial cable not only of the finest characteristics initially but of absolute permanence of its characteristics throughout service life. * * * * * * * * *

In high pressure gas or oil cables which are used for the highest voltages, aluminum could replace lead fairly completely, since the strength of aluminum permits the re-enforcement to be omitted.

In duct cable (other than high pressure cables) which comprises the great bulk of lead-sheathed power cables in the United States, the use of aluminum sheath is problematical owing to its greater stiffness and the necessity for training the cable around manholes to take care of expansion. These and other problems have to be overcome. Already from dummy manhole tests it appears that aluminum sheath cable has a much higher flexing life than lead. The transition will be gradual at most because of the extreme conservatism of utility engineers.

★ ★ ★

Abroad, aluminum-sheathed cables will come in more quickly because most of the cables are directly buried in the ground, hence expansion problems are eliminated and at the same time there is a double saving, namely, that on the metal sheath itself and that on the re-enforcement which the strength of the aluminum makes unnecessary. In addition, several large extrusion presses are being built in England and one of 8,000 tons in Germany. These machines can sheath tremendous quantities of cable and it is certain, because of the large investment they represent, that they will not be allowed to remain idle. These considerations appear to insure that a substantial percentage of power cable in Europe will, within the next two years, be sheathed with aluminum.

Conclusion

Lead has been in use for piping and sheathing for over 2000 years. Its characteristics are well-known and particularly its resistance to corrosion. Yet the new-comer aluminum has sufficient technical and economic advantages to constitute a real threat to lead in the cable sheathing field. Despite its weakness to corrosion and the difficulty of joining or patching it, aluminum cable sheathing will come into wide use in Europe in the next few years. In America the change will come more slowly. Telephone cable will probably use aluminum sheath almost entirely within five years or less. In the power cable industry the transition will come more slowly owing to expansion problems in underground ducts and the conservatism of the utility industry.

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A Review of Fluorothene in the Wire and Cable Industry

by F. W. Wurtzell, W. J. Canavan and B. H. Maddock
Development Engineers
Bakelite Company, a Division of
Union Carbide and Carbon Corporation,
New York, New York

This paper prepared for presentation at the Annual Convention of the Wire Association in Chicago on November 10, 1953, is concerned with a synthetic resin that relatively recently became commercially available. The resin has some excellent properties, which the authors ably describe.

It took the second World War to bring fluorocarbons out of the laboratory into commercial production. The famous Manhattan Project set up the first major program to obtain quantity production of these materials for use as coolants, liquid seals, and lubricants. Polymonochlorotrifluoroethylene was born during this project. Commercial production of this resin has been accomplished by Union Carbide and Carbon Corporation after four years' intensive study by its combined research, development and production staffs. Today, large quantities of fluorothene—the generic term used for polymonochlorotrifluoroethylene — are available to the wire industry.

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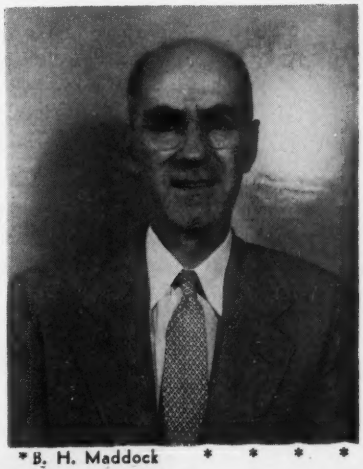
Bakelite Company markets fluorothene in three grades: CF3-5, CF3-15 and CF3-50. Each grade is designated by melt viscosity at 446 deg. F. The number following the symbol CF3 is the melt viscosity in megapoises. The three grades of resin, which also differ in molecular weight, have all been used for wire and cable extrusion work. The CF3-50 resin is not particularly applicable for these wire and cable applications because of its inability to maintain its initially high molecular weight during the extrusion process. On the other hand, there does seem to be some advantage in using the CF3-5 or CF3-15 resins. These resins can be extruded at lower temperatures, thereby minimizing viscosity degradation during extrusion. In addition, they can be extruded at rates higher than is normally possible with the higher molecular weight grades.

★ ★ ★

In general, the properties of the three grades are not significantly different. All are outstanding in their resistance to commonly encountered chemicals and solvents. They are unaffected by strong oxidizing agents such as white fuming nitric acid and aqua regia. Frey, Gibson and Lafferty[3] have shown the excellent chemical resistance of fluorothene.

* F. W. Wurtzell * * * * *

* W. J. Canavan * * * * *



* B. H. Maddock * * * * *

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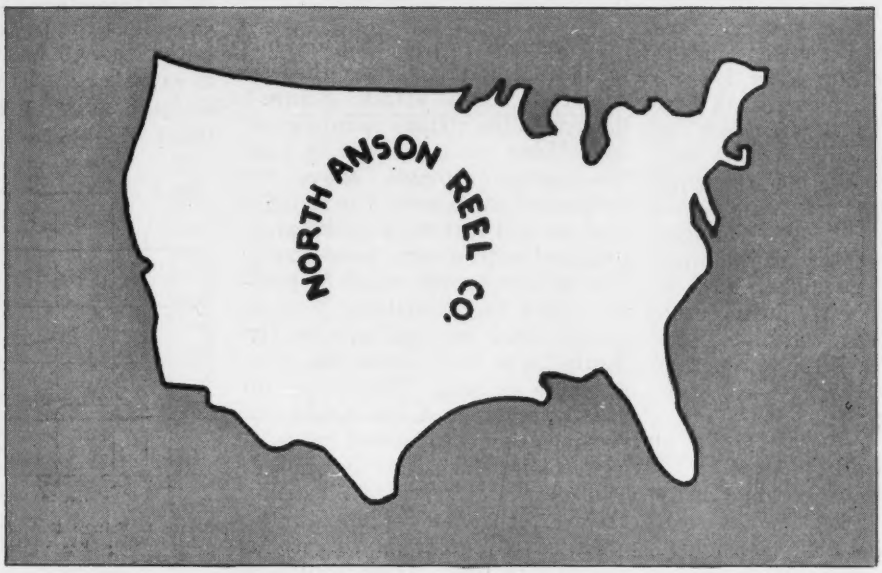

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Their excellent chemical resistance, recommends their use as insulation and protective coverings for wires in chemical plants and in devices operated in corrosive or oxidizing atmospheres.

★ ★ ★

Fluorothene, when properly fabricated, does not readily shatter even at temperatures as low as —328 deg. F. It also resists flow under low to moderate loads at temperatures as high as 392 deg. F. Effective operating temperatures of insulated wires are somewhat lower than these extremes due to melt viscosity degradation during extrusion which results in increased crystallinity during cooling. Commercially available insulated wires appear to operate satisfactorily between —40 deg. F. and 302 deg. F .

★ ★ ★

Over a temperature range of 68 deg. F. to 390 deg. F., the electrical properties of fluorothene vary as shown in Table I[4].

Table I

Temp. deg. F.	Dissipation Factor at one megacycle	Dielectric Constant at one megacycle	Short Time Dielectric Strength—corrected to ⅛"
68	.0085	2.32	—
77			410
140	.0200	2.38	617
203	—	—	613
212	.0420	2.48	—
266	—	—	519
284	.0385	2.65	—
356	.0220	2.75	—
390	.0150	2.77	—

Fluorothene has an extremely high volume resistivity in excess of 10^{16} ohm-cms. The dielectric constant and dissipation are not as low as those of polyethylene but the values are vastly superior to the vinyl chloride type electrical compounds. Shielded radio frequency cable, type RG-108/U, insulated and jacketed with fluorothene, exhibited a characteristic impedance of 76 ohms at 120 deg. F. at one megacycle. The capacitance of this cable was 20.96 micromicrofarads per foot at 120 deg. F. and one megacycle. When insulated with polyethylene, the impedance and capacitance values were well within the limits specified for this type of cable —76 ±6 ohms for impedance and 25 micromicrofarads per foot for capacitance. It is believed that the electrical properties of the fluorothenes are sufficiently good to allow their use on all but the critical high-frequency applications.

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In common with most organic insulating materials, fluorothene is subject to corona attack. Figure I illustrates the voltage endurance of fluorothene insulated wire at various voltage stresses, above the corona initiation level. The samples used in this test were deliberately prepared with a very loose insulation so that corona would be present under the insulation. A loose copper braid was applied over the insulation so that corona was present here as well. This is an unusually severe test and would not normally be encountered when a tight fitting insulation is applied. The data does serve to illustrate, however, that fluorothene in the presence of corona is subject to failure with time. As an insulating material it should be handled with the same engineering consideration accorded other insulations in guarding against the presence of corona.

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Considerable work has been done in investigating the long time aging properties of fluorothene insulated wire at room temperature; immersed in water at room temperature; and in a heated oven at 300 deg. F. Table II illustrates the performance of fluorothene insulated wire after 10 weeks aging in these environments. The criterion of quality is retention of dielectric strength. From Table II, it can be seen that there was no change in the dielectric strength of the insulated wire after the room temperature aging or water immersion. During oven aging, the dielectric strength drops during the first two weeks, then stabilizes with no further decrease. The initial change is due to the increase in crystallinity and spherulite growth in the polymer. After this initial change has taken place, it is expected that the material will remain stable practically indefinitely at 300 deg. F.

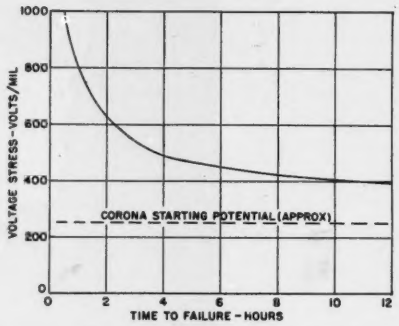

Figure 1. Voltage Endurance of Fluorothene Insulated Wire. (#22 stranded wire, 10 Mil Wall, 60 cycles.) * * * * * * * *

The oven aging data included above indicates that under the present method of insulating with fluorothene, the wire will remain serviceable indefinitely at operating temperatures up to 300 deg. F. Higher temperatures increase the rate and degree of crystallization and spherulite growth and result in a more brittle insulation. This embrittlement results in a loss in elongation and flexibility. It also leads to a decrease in dielectric strength after aging. Additional work now underway is aimed at determining whether the present maximum operating temperature can be increased.

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In its mechanical properties fluorothene behaves like a rigid material even though it is flexible in thin sections. Its tensile strength is approximately 5,000 lb. per sq. in. at room temperature and it can be elongated 5 to 8 per cent without permanent deformation. If strained beyond this level, it necks down and, before breaking, orients in much the same manner as polyethylene. It should not be considered as an insulation for wires where the degree of flexi-

Table II

Long Time Aging at Room Temperature, Immersed in Water at Room Temperature and Oven Heated at 300 deg. F.

No. 22 stranded, silver plated conductor, 9 mil wall of CF3-5 resin. Flow index on insulation: 187 mg. per min. = 2.4 megapoises
Shrinkage on insulation: 68 per cent
Breakdown Voltage, Kilovolts
2x mandrel bend plus 1 hr. in water after aging

Aging Time Weeks	Storage at Rm. Temp.	Water at Rm. Temp.	Oven at 300 deg. F.		
	Avg.	Avg.	Avg.	Min.	Max.
0	>16.0	16.0	16.0		
1	"	15.6	10.1	5.0	12.5
2	"	14.4	8.1	6.0	10.0
3	"	15.5	8.5	6.0	10.5
4	"	15.8	8.8	6.0	11.0
5	"	14.9	8.8	5.5	10.5
6	"	13.9	8.3	6.0	10.0
7	"	15.0	8.1	6.0	9.7
8	"	15.1	7.5	4.5	11.0
9	"	16.0	7.8	4.5	12.0
10	"	16.0	9.9	9.0	10.7

bility normally associated with rubber or plasticized vinyls is required, unless advantage can be taken of the considerably decreased wall thicknesses generally employed.

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The toughness, deformation and abrasion resistance of fluorothene are retained over the operating temperature range. This minimizes the need for braids or other protective coverings.

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The viscosity versus temperature curve of fluorothene as shown in Fig. 2[5], has approximately the same slope as the one for polyethylene, although the transition point is about 212 deg. F. greater. Thus fluorothene can readily be extruded in conventional equipment at temperatures of 500 to 600 deg. F. and no additional sintering or other operations are required.

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Above the transition point, the viscosity gradually decreases for both fluorothene and polyethylene. However, at extrusion temperatures, fluorothene resin has a viscosity approximately 10 to 20 times that of polyethylene at the same stage.

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Unlike polyethylene, fluorothene cannot be subjected to extrusion temperatures high enough to reduce its viscosity to a point where it would flow readily without serious degradation. Temperatures over 540 deg. F. cause a melt viscosity decrease in fluorothene. This decrease in melt viscosity or molecular weight is a function of time and temperature. Since the temperatures required for extrusion are in the neighborhood of 572 deg. F., it is important that the resin remain in the extruder as short a time as possible. It is felt that the melt viscosities of the finished wire insulation should not be less than 1½ to 2 megapoises for satisfactory operation at temperatures up to 300 deg. F.

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Electrically heated equipment seems to be best suited and is normally used to fabricate fluorothene, although special heat transfer oils may make the use of oil-heated machines possible. For the tests conducted thus far a 1½ inch electrically heated extruder was used for most wire extrusion works. Fig. 3 shows a vertical type extrusion unit.

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This extruder was originally equipped with a nitrided stainless steel cylinder, 21 inches long and a nitrided stainless steel screw. Cylinder heat was provided, by two 3,000 watt band heaters individually controlled by Wheelco electronic controllers. Two separately controlled cooling zones in a cored jacket provide cooling where required. The cooling medium used is compressed air. Elec-

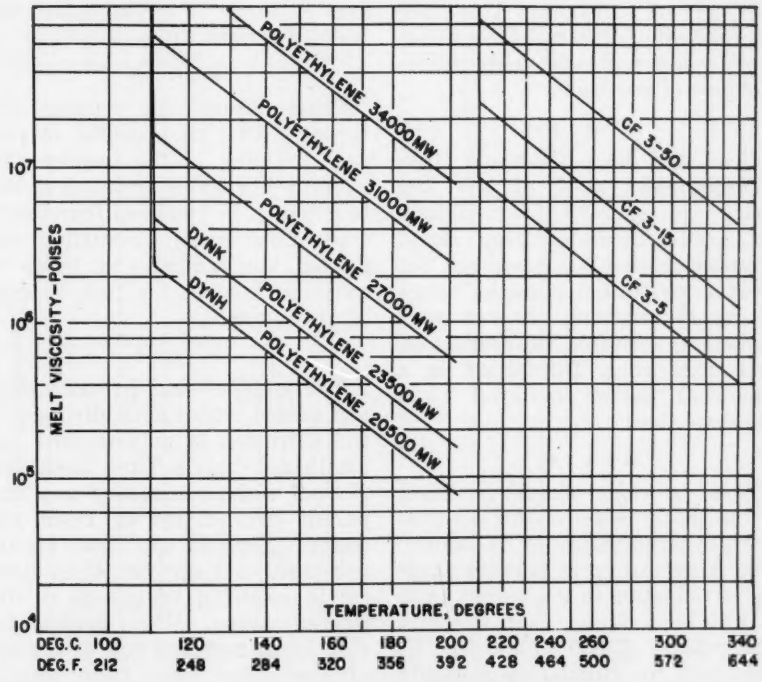

Figure 2. Comparison of Melt Viscosity versus Temperature Curves of Fluorothene with Polyethylene.

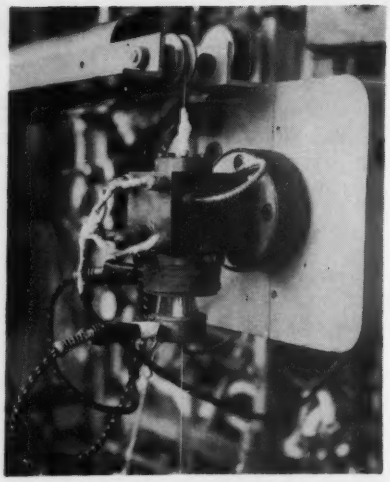

Figure 3. Vertical Type Extrusion Unit. * *

trical heaters are used on the crosshead and die with the head controlled by a Wheelco electronic controller and the die adjusted by means of a Variac.

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A screw made from Duranickel, having a constant pitch variable depth giving a compression ratio of 1.49/1, has been found satisfactory. This screw proved to be satisfactory and no evidences of corrosion have been noted to date. A replacement cylinder liner was made with Xaloy 306, an alloy of nickel, cobalt, chrome, molybdenum, silicon, and boron. This liner has operated intermittently for three years now with only slight evidence of corrosion.

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Head and die parts made from 18-8 stainless steel of the 300 series are generally satisfactory but are difficult to keep clean. Duranickel parts are preferred but greater precaution must be taken to prevent marring. Faster wear should be expected in production operations since Duranickel is a somewhat softer material than stainless steel.

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Some provision should be made in the machine set-up for controlling the temperature of the worm. This is necessary to prevent surging or pulsation in the output rate. It has been found that a worm temperature of 350 to 400 deg. F. (obtained by circulating hot oil) is the most desirable. At screw temperatures below 300 deg. F. the extrusion rate decreases, while temperatures over 400 deg. F. cause a premature fluxing of resin on the feed thread and subsequent blocking at the feed hopper.

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Temperatures used on the other sections of the machine are determined by the balance between conducted and frictional heat. As previously mentioned, viscosity degradation begins to occur at 536 deg. F. and the temperatures used should be as low as possible consistent with proper flow or resin plasticity at the die. The compound extrusion temperature recommended for fluorothene is 560 to 600 deg. F. depending somewhat on the original grade being extruded. With no temperature control in the screw, head and cylinder temperatures in excess of 600 deg. F. are often required. Cylinder temperatures as low as 450 deg. F. may be achieved with a screw temperature of 350 to 400 deg. F. because of the additional frictional heat generated. Once the proper balance of input heats have been determined, careful and accurate control of these temperatures are desired. A range of ± 5 deg. F. is recommended for the cylinder and head while a ± 30 deg. F. range is recommended for the die temperature.

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Some means for cooling the throat should be provided to prevent bridging in the hopper. Circulating hot water or steam at 200 to 300 deg. F. has been found suitable. Cold water circulation has proved too radical and tends to cause packing in the rear threads of the screw.

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The conventional breaker plate and screen set-up normally used in the extrusion of polyethylene and plasticized vinyls have been employed without causing any apparent degradation of resin viscosity. Screens are not always necessary but appear to be helpful in reducing roughness in dry colored resins. Other devices for restricting material flow at the end of the screw have been equally effective.

Dies and tips for use with fluorothene differ from those used in the extrusion of plasticized vinyls and polyethylene. With fluorothene the draw-down technique (similar to that used in extruding nylon) is employed. Using this technique, the die size is appreciably increased and the resultant oversized tube is pulled down onto the wire as it leaves the die, assisted by a vacuum on the guider tube, if necessary. While tubing dies and guiders with ½" to 1" parallel lands are used ordinarily, the actual land length does not seem to be too critical. In general, the shorter land lengths will give increased extrusion speeds with more surface roughness. Higher temperatures will then be required to eliminate the roughness and increased viscosity breakdown may be experienced.

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Roughness on the inside of the extruded tubing is often encountered when using the tubing technique. This roughness is attributed to the cooling action of the guider pin as the fluorothene flows over it. If the head temperature is raised sufficiently to heat the pin by conduction, undue degradation is likely to occur in the head. Increasing the cylinder temperature to deliver the resin to the head at a higher temperature so that the pin may be heated by the resin flowing over it results in excessive viscosity degradation in the cylinder. In any case, the resin leaves the die hotter than necessary.

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A unique solution to this problem is accomplished by inserting a resistance wire heater in the pin. This permits the pin temperature to be regulated independently and makes possible the lowering of the cylinder and head temperatures. With this method, using an oil-cooled "metering" type screw, it has been possible to extrude resin CF3-15 at 450 deg. F. on the front and rear cylinder, 500 deg. F. on the head, 520 deg. F. on the die, and with a compound temperature of 550 deg. F.

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Table III shows the optimum

temperature setting used at a screw speed of 12 rpm with the screw controlled at 375 deg. F.

Table III

	Extruder Temperature, deg. F.		
	CF3-5	CF3-15	CF3-50
Throat	250 to 300	250 to 300	250 to 300
Rear Cylinder	430 to 450	440 to 460	450 to 480
Front Cylinder	450 to 500	470 to 520	500 to 550
Head	500 to 540	500 to 550	550 to 600
Die*	570 to 600	580 to 600	600 to 640
Compound Temperature**	560 to 590	570 to 600	580 to 610

* The die temperature is a function of the time in the die which, in turn, is dependent on the land length and the extrusion rate. Ordinarily, the die temperature must be raised as the screw speed is increased.

** Measured at the die.

Fluorothene is recognized as having a crystalline structure. (6) This being the case, the rate of cooling has a marked effect on the crystal size and accordingly on the physical properties of the resin. If cooled rapidly to room temperature or below from above the transition temperature of 410 deg. F., it is highly transparent in thin sections, suggesting an amorphous structure. In this state, the polymer exhibits maximum flexibility, toughness and impact resistance. Crystallinity actually exists in the quenched state but the crystals formed are of such a minute size, that light scattering does not result. A water quenched polymer is about 50 per cent crystalline. Complete transparency cannot be obtained in thicknesses greater than 100 mils because the low thermal conductivity of the polymer does not permit rapid cooling of the inner layers.

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If the resin is cooled slowly, it becomes translucent indicating a higher degree of crystallinity and the existence of spherulites. In this state the polymer is inclined to be translucent, stronger, harder, but more brittle than a quenched specimen.

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Spherulite growth in quenched samples occurs if the samples are exposed for extended periods of time at elevated temperatures of 300 to 410 deg. F. The spherulites, however, are smaller than those obtained in slowly cooled samples. Increasing the molecular weight of the resin decreases both the rate and ultimate size of the spherulite growth. The desirability of maintaining as high a molecular weight as possible in the finished extrusion is emphasized by this effect.

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This continued crystal growth and aggregation results in embrittlement of the wire insulation. The larger the crystal size the more brittle the material becomes. If such a wire is flexed after heat aging, cracking and dielectric failures are likely to result.

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The upper operating temperatures for fluorothene insulated wires are determined by the embrittlement encountered due to this crystal growth and not by thermal breakdown of the resin as is generally the case with plasticized vinyl chloride. This being the case, the importance of minimizing melt viscosity degradation during extrusion becomes more evident. It is believed that an upper operating temperature of 392 deg. F. could be attained if the final insulation possessed a viscosity of 25 to 30 megapoises and the proper degree of strain were present in the final insulation.

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Recent work has illustrated the importance of the presence of strain in the insulation. It has been recognized that one method which might be employed to reduce the rate of crystallinity and spherulite growth would be to orient the resin. The oriented chains would tend to have less mobility and by their position inhibit the development of crystallinity and spherulite growth. Fig. 4 illustrates the retention of voltage breakdown after one week's aging at 300 deg. F. of various fluorothene insulated wire samples having various degrees of shrinkage. The individual points from which these curves are drawn are given along with the melt viscosity of each sample. Provided the sample has a viscosity of 1½ or higher, the retention of dielectric strength is practically independent of final viscosity. On the other hand, the dielectric strength is dependent on the shrinkage or

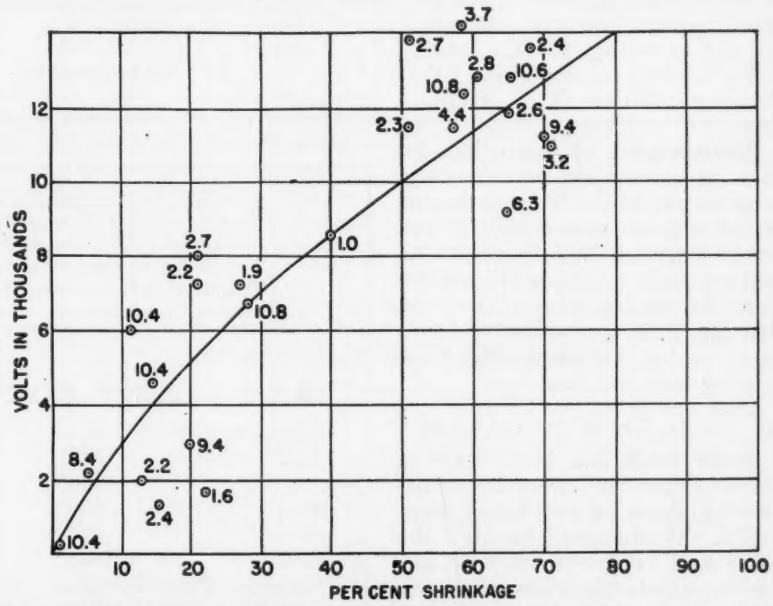

Figure 4. Shrinkage versus voltage breakdown of Fluorothene wire insulation after one week at 300°F.

orientation present in the finished insulation. It is felt that shrinkages on the order of 50 to 70 per cent are most desirable.

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The effect of the presence of strain has led to the possibility of aging samples at temperatures in excess of 300 deg. F. Table IV illustrates the aging results obtained with samples having various degrees of strain, when aged at temperatures up to 375 deg. F. Samples A and B having shrinkage on the order of 65 per cent retain a very large portion of their initial dielectric strength after aging for one week at 355 deg. F. Samples E and F which have a low degree of strain but a higher melt viscosity show much poorer performance when aged at temperatures as low as 160 to 170 deg. F. This data again illustrates the emphasis which should be placed on the desirability of having a strained insulation.

Table IV

Effect of Strain on High Temperature Aging Properties

No. 22 stranded conductor, 9 to 10 mil wall

	Wire Sample					
	A	B	C	D	E	F
Melt Viscosity, Megapoises	4.0	2.8	2.9	2.0	8.4	10.4
Shrinkage, per cent	65.0	65.0	51.0	27.0	11.0	5.0
Voltage Breakdown						
2x mandrel bend + 1 hr. in water after aging 1 week at:						
300 deg. F.	14.5	11.8	13.8	7.1	7.6	7.2
320 deg. F.	10.2	7.0	7.9	2.2	3.2	2.0
340 deg. F.	9.9	7.1	8.8	3.8	3.0	1.8
355 deg. F.	6.4	7.0	6.1	1.8	cracked	cracked
375 deg. F.	4.3	—	—	—	—	—

The presence of strain has led to some speculation regarding the temperature at which these strains would relieve themselves. It has been illustrated that these strains will not start to relieve themselves until the melting point of the resin 410 deg. F. is approached which is in excess of the contemplated operating temperatures.

★ ★ ★

Some work has been done on investigating the effect of insulation tightness on heat aging properties. Conductors having the same wall thickness but with different outside diameters, thus providing tight and loose insulation, have been aged at 300 deg. F. for periods as long as three weeks. This data is summarized in Table V. The sample with the loosest insulation showed the best retention of dielectric strength after aging. It is believed that this is due simply to the fact that during mandrel bending after aging, a loose insulation will have a lower degree of strain induced in it, due to the looseness and will therefore show less tendency towards cracking and loss of dielectric strength.

★ ★ ★

Quality controls for the finished wire should logically be based on a determination of the final average molecular weight. While this may be accomplished by oven aging tests, these tests are time consuming and not readily adaptable to control testing.

★ ★ ★

The melt viscosity can most easily be determined by using an instrument known as the flow indexer. (This instrument, an extrusion plastometer operating at low rates of shear, is similar in design and operation to the ICI Grader.[1] It gives a value known as the flow index which can be correlated directly with melt viscosity. The instrument can use a wide variety of test specimens including insulation stripped from wire, powdered or pelletized material or pieces cut from a molded item.

★ ★ ★

Another possible method of rating resins is by the no strength temperature test (NST)[2]. In this test a standard notched specimen is suspended in a small oven at 410 deg. F. under a given load. The temperature is then raised at a fixed rate and the temperature at which the sample parts is noted and called the no strength temperature.

★ ★ ★

Results which can be obtained using the NST test are limited by the starting temperature. In Fig. 5[1] a correlation of NST values with melt viscosities is shown. The striking lack of correlation in the melt viscosity range of major interest, from 1 to 5 megapoises, should be noted. Such lack of correlation is primarily the result of the high starting temperature, and the time necessary to heat the sample. If a non-standard specimen, such as a tube of insulation removed from insulated wire is

Table V

Effect of Insulation Tightness on Heat Aging Properties

No. 22 stranded, silver plated conductor, nominal 10 mil wall.
Resin used: CF3-5, initial MV = 8.3 megapoises.
Flow index on insulation: 140 mg. per min.
Equivalent melt viscosity: 3.2 megapoises
Original Breakdown Voltage after 1 hour in water: >16.0 KV

OD. mils	Shrinkage per cent	* Breakdown Voltage, KV 2 x mandrel bend plus 1 hr. in water after heating at 300 deg. F. for 1 week	2 weeks	3 weeks
50-tight	70.7	10.9	8.7	6.8
50-51	72.0	5.9	8.7	6.0
51-52	70.7	9.3	5.8	—
52-53	70.5	9.4	9.4	—
55	67.0	10.5	9.4	—
56-60	66.3	14.0	8.9	14.8

* Average of four specimens. Voltage held at 2.0 KV for 1 minute, then raised at 500 volts per second to breakdown.

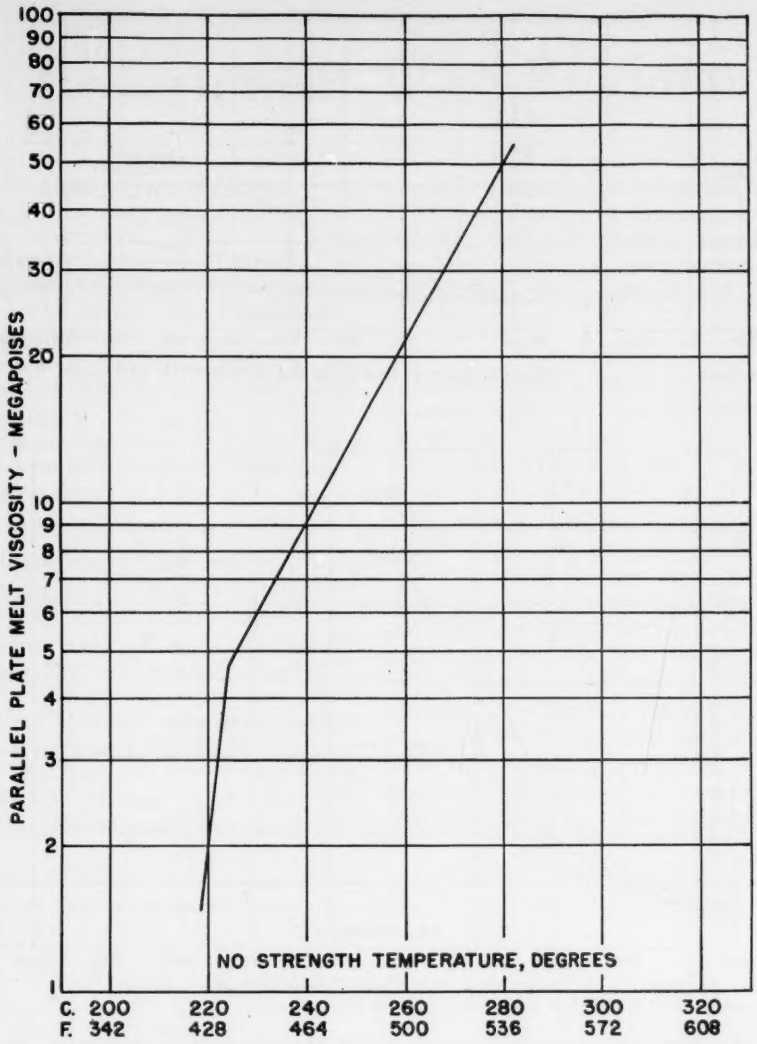

Figure 5. Correlation of No Strength Temperature Values with Melt Viscosities of Fluorothene Wire Insulation.

tested, residual strain in the sample can have a large effect on the NST value obtained.

★ ★ ★

Table VI shows the effect of shrinkage on NST values obtained on specimens removed from finished wire. This table shows samples having essentially the same melt viscosity which give widely different NST's depending on the residual strain present. It would appear that the flow indexer is the instrument meriting further widespread interest.

★ ★ ★

The flow indexer can also be used to determine the effect of additives such as colorants which may be used with the fluorothene resin. Most additives have an effect on the stability of the base resin and this effect should be defined in order to eliminate those materials which might adversely affect the stability.

★ ★ ★

The flow indexer is particularly useful in determining this. A resin containing various percentages of the additive under investigation can be run in the flow indexer with samples being taken at 100-second intervals. By plotting the relative extrusion rate, (that is, the ratio of the rate at any given time to the minimum value) as a function of time, a measure of stability independent of the initial viscosity can be obtained. Figs. 6, 7 and 8 illustrate the effect of three such additives, a cadmium red, an iron oxide and a cadmium yellow. The cadmium pigments illustrate a very definite stabilizing effect on the base resin while the iron oxide red causes a sharp decrease in resin stability. Based on this data, the iron oxide red would be eliminated from consideration as a pigment. A melt index test can be run in 10 minutes and concurrently with the actual extrusion operation. Values obtained by this test should not be over 300 mgs per min. equivalent to a melt viscosity of 1.5 megapoises for optimum heat aging properties. Other properties which should be controlled are shrinkage and size.

★ ★ ★

Fluorothene is being used commercially today as insulation on high temperature hookup wires. These wires employ a 10 mil wall of insulation over a silver plated conductor. Circuit identification is obtained by pigmenting the fluorothene by the tumbling process.

★ ★ ★

Another wire developed for use in chemical environments utilizes

Table VI

Effect of Strain on NST of Wire Insulation

#22 Stranded Conductor — 10 mil wall

Sample	Melt Viscosity Megapoises	Shrinkage Per Cent	NST of Wire Insulation in Degrees F.
A	10.4	3	439
B	9.4	20	457
C	9.4	70	504
D	2.2	0.7	424
	2.2	13	431
	2.2	57	442

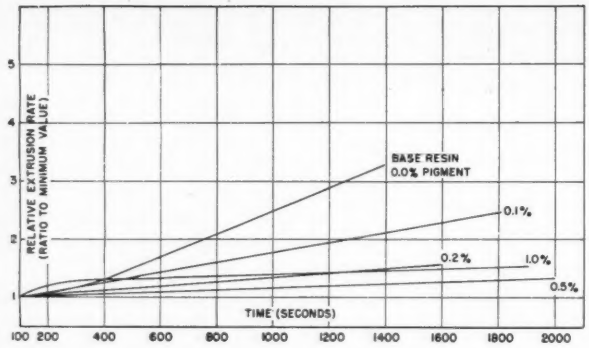

Figure 6. Effect of Cadmium Red on Stability of Fluorothene. * * *

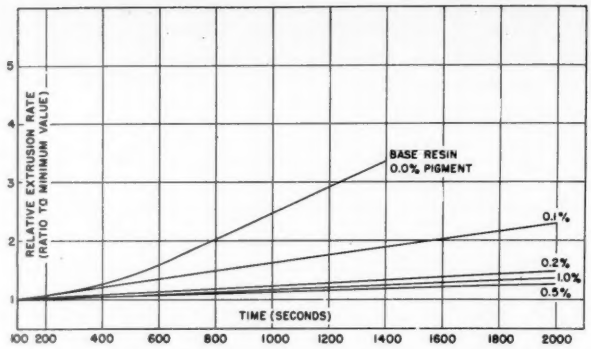

Figure 7. Effect of Iron Oxide Red on Stability of Fluorothene. * *

a 10 mil transparent fluorothene jacket over a vinyl or polyethylene core approximately .150 mils in diameter. The vinyl or polyethylene core is used to build up the diameter of the finished wire so that standard available connectors and fittings may be used.

★ ★ ★

It is felt that fluorothene has a very definite place in the wire industry. The combination of flame resistance, weathering, moisture and chemical resistance, high, electricals, toughness and good extrusion characteristics should make it interesting to wire and cable engineers for many applications other than those already listed. Research and development programs by Bakelite Company are being actively prosecuted and the information obtained will be made available to every interested manufacturer.

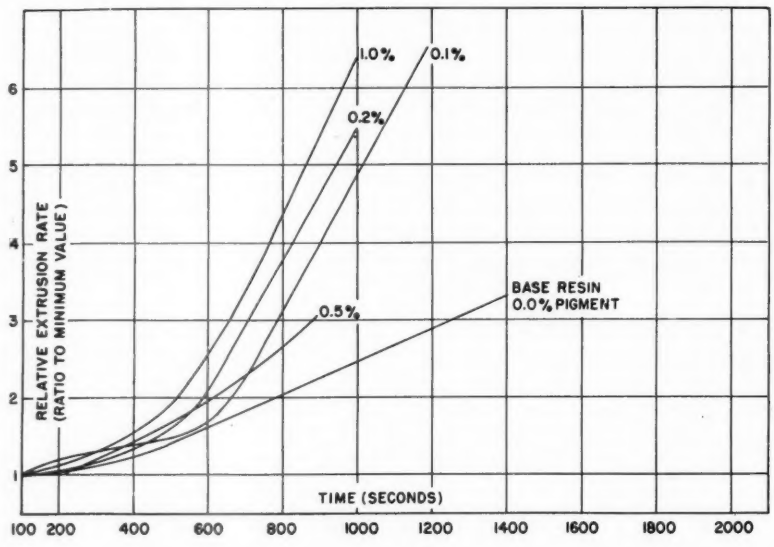

Figure 8. Effect of Cadmium Yellow on Stability of Fluorothene. * * * * * * * *

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F. W. Wurtzell graduated from the University of Illinois in 1942 with a B.S. degree in Chemical Engineering. He was employed by the Bakelite Company in 1942 as a Research and Development Engineer on wire and cable insulations. In 1946 he was transferred to the Sales Department as a Technical Representative in the greater New York area. Since 1948, he has served as Technical Representative in the Midwest. Mr. Wurtzell is a member of the A.C.S., A.I.E.E., and I.A.E.I.

W. J. Canavan graduated from Stevens Institute in 1944 with a degree of B.S. in Mechanical Engineering. He joined Bakelite Company the same year and served as a Technical Representative with the Sales Department until 1951. From 1951 until the present, Mr. Canavan has been associated with the Sales Development Department. As development engineer, he is concerned with wire insulating and jacketing materials and dielectrics.

B. H. Maddock was graduated from the University of Michigan in 1934 with a B.S. degree in Engineering Physics. He has been employed by Bakelite Company from 1936 to 1942 and from 1945 to the present. He participated in the development of "Halowax," "Vinylite," polyethylene and fluorothene dielectric materials. From 1942 to 1945 he was employed by Federal Telephone and Radio Corporation in the development and manufacture of high frequency transmission lines.

Government Wire Production Information

Announcement of New Publication

Electrodeposition Research, Proceedings of the NBS Semicentennial Symposium on Electrodeposition Research held at the NBS on December 4-6, 1951, National Bureau of Standards Circular 529, 129 pages, 38 figures, 19 tables, buckram bound, $1.50. (Order from Government Printing Office, Washington 25, D. C.)

★ ★ ★

Electrodeposition processes have become an integral and important part of many industries—for example, the printing, metal refining, extractive metallurgy, hardware, automobile, and electronic industries. This has come about largely as a result of extensive research in the field of electrodeposition, especially during the past 25 years. This volume contains the papers given at a symposium sponsored by NBS to encourage further research in this field, to present current research results and problems, and to facilitate the exchange of information.

★ ★ ★

Representing a cross section of research currently being conducted in electrodeposition by industrial, university, and government laboratories in Europe and the United States, the papers cover such topics as research on electrodeposition in Great Britain, the United States, France, Germany, Belgium, and Holland; electrodeposition research at Battelle Memorial Institute, United Chromium, Inc., the Bureau of Mines, Armour Research Foundation, Westinghouse Electric Corporation, and Sylvania Electric Products; research at Enthone, Inc., on metal finishing; brass plating; electroplating in the sleeve-bearing industry; corrosion resistance of copper, nickel and chromium-plated zinc, aluminum and magnesium base die castings; determination of impurities in electroplating baths; effects of impurities in plating solutions; porosity in deposits; correlation of gas permeability of electrodeposits with their weathering behavior; properties of electrodeposited nickel; disposal of cyanide wastes from plating operations; current and metal distribution in electrodeposition; and a new degreasing evaluation test: the atomizer test.

★ ★ ★

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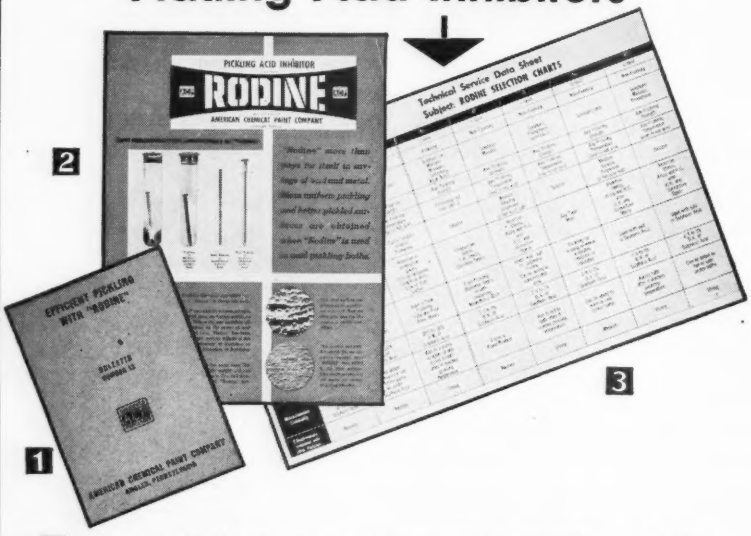

1 The standard reference work on pickling, "Efficient Pickling With RODINE" — Bulletin Number 13 — is now available in a new, revised edition.

2 This new 4-page general descriptive folder presents essential information on "Rodine" pickling acid inhibitors.

3 The recently revised "RODINE SELECTION CHART" gives characteristics of and uses for typical "Rodines" used with sulfuric and muriatic acids. Technical Service Data Sheet No. 13-1-1-4.

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Scarce Materials Designated

Pursuant to Section 102 of the Defense Production Act of 1950, on June 18th the NPA issued an amended list of scarce materials from which most materials were deleted. Metals and minerals remaining in the "Scarce material category" are as follows:

Chromium—all forms of ferro-chromium including those alloys known as ferro-silicon chromium and ferro-chromium silicon, chromium nickel, chromium metal, and all other compositions containing more than 25% chromium, which are used as sources of chromium in commercial manufacture or processing.

Cobalt—cobalt metal, cobalt fines, cobalt oxide, cobalt powder, and all other cobalt compounds produced from ores, metals, concentrates, and/or refinery residues, as well as scrap containing more than 5% cobalt, which are used as sources of cobalt in commercial manufacture and processing.

Columbium and Tantalum—ferro-columbium and ferro-columbium tantalum.

Molybdenum — ferro-molybdenum, all grades of molybdenum oxide, and all primary molybdates and other molybdenum compounds used as a source of molybdenum in commercial manufacture and processing. It does not include the molybdenum present in steel scrap or pure molybdenum metal or scrap molybdenum metal.

Nickel—only the following forms of primary nickel: electrolytic nickel, ingots, pigs, rondelles, cubes, and pellets, rolled and cast anodes, shot, oxides, salts, and chemicals and residues derived directly from new nickel, including residues containing nicked derived as a byproduct from copper refinery operations.

Diamond grinding wheels.

Some of the materials withdrawn from the category are:

- Pig Iron
- Carbon Steels
- Stainless Steels
- Aluminum
- Asbestos
- Beryllium
- COPPER AND copper-base alloys
- Industrial diamonds
- Mica
- Tungsten
- Titanium
- Rubber (natural)

Corrosion Resistance of Galvanized-Steel-Stitched Aluminum Alloys

The National Bureau of Standards, at the request of other government agencies, has investigated the corrosion resistance of sheets of unclad and aluminum-clad 24S-T3 aluminum alloy stapled together with galvanized steel wire. Stapled specimen sheets of this high-strength aluminum-copper-magnesium alloy (containing

about 4½ per cent copper and 1½ per cent magnesium) were exposed in a marine atmosphere and in the tidewater. Results for exposure periods up to 37 months indicate that both types of sheet joined in this fashion have satisfactory corrosion resistance for service in marine atmospheres. Where the installation is subject to frequent wetting by sea water, however, only the alclad alloy appears satisfactory. The Bureau's study was conducted by Fred M. Reinhart of the NBS corrosion laboratory, under the sponsorship of the National Advisory Committee for Aeronautics, the Navy Bureau of Aeronautics, and the Air Force Wright Air Development Center.

★ ★ ★

Galvanized-steel-wire stitching, or stapling, as a means of joining aluminum sheets has been used increasingly since early in World War II. Fast and economical, this relatively new method has given good results in the construction of non-load-bearing walls and partitions in the interior of aircraft. Although the joints are not inherently as leakproof as those made by other methods, the use of suitable sealing materials can overcome this objection. Wire stapling of sheet metal is reported to have been extended more recently to non-aircraft applications, including interior panels in buses and in houses. Thermally insulated wall panels are readily fabricated by stapling layers of insulating material to the metal sheeting; a single stapling operation can fasten the insulation to the metal sheets as well as joining the sheets to each other.

★ ★ ★

In the NBS work, stapled panels of each material (24S-T3 and alclad 24S-T3) were subjected to intermittent sea-water immersion by exposing them in the tidewater. Other panels of each material were exposed in a marine atmosphere but not subjected to wetting. Panels were observed periodically and were removed for macroscopic and microscopic study after exposure periods of 6, 11, 22, and 37 months.

★ ★ ★

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The unclad 24S-T3 panels exposed to tidewater deteriorated rather rapidly. After 2 months the zinc coatings on the steel staples were white with corrosion. After 6 months the zinc was entirely gone from the staples, which by this time were covered with dark adherent rust. Microscopic inspection at 6 months showed that directly underneath the staples the sheets had cracked by stress corrosion, the cracking having started at the faying surfaces of the sheets. By the end of 37 months the staples were badly rusted and pitted, and the sheets in the area of the staples had suffered severe crevice corrosion, intergranular corrosion, and stress corrosion cracking.

★ ★ ★

The alclad 24S-T3 panels stood up much better in the tidewater exposure. The attack on the zinc coating of the staples was much less severe. Even after 37 months some of the zinc-iron alloying layers were still present and the underlying steel had barely begun to pit. There were no corrosion products between the faying surfaces of the alclad sheets, indicating little if any crevice corrosion. Although most of the aluminum cladding had disappeared from the faying surfaces at 11 months, the core material had not been attacked even at 22 months. Only after 37 months exposure did the core show pitting and—but only in one area—stress corrosion.

★ ★ ★

When exposed in a marine atmosphere, there was very little corrosion of either the alclad or the unclad alloy, even after 37 months. The staples on both specimens were still coated with grey corrosion products, indicating that zinc or zinc-iron alloy layers were still present. None of the staples were significantly pitted. The faying surfaces of the 24S-T3 panel were slightly pitted, but no evidence of intergranular corrosion or stress corrosion cracking was found. The protective aluminum layers on the alclad 24S-T3 sheets were pitted at a few areas of the faying surfaces, but in no case had the pits corroded to half of the thickness of the layers. Crevice

corrosion was quite mild—there were only small amounts of corrosion products beween the faying surfaces of the unclad panels and practically none between those of the alclad panels.

★ ★ ★

Because of the crevice corrosion that developed, in varying degrees, at the faying surface of the joints, the application of a protective coating to these surfaces appears to be desirable for maximum service life as well as for leakproofing the joint. A nonabsorbing type of sealing compound or paint can be applied to the joints either during or after the joining operation.

GSA Establishes Materials Division

Establishment of a Materials Division in the General Services Administration has been announced by Administrator **Edmund F. Mansure.**

★ ★ ★

The new Division will take over the procurement responsibilities for metals and minerals formerly handled by the Defense Materials Procurement Agency. The latter was abolished August 15 by Executive Order, and its remaining functions, duties and personnel transferred to GSA.

★ ★ ★

Mr. Mansure, who also served as DMPA Administrator until it was abolished, said the new Division will be a part of the Emergency Procurement Service, the GSA unit that handles national stockpile procurement, transportation and storage.

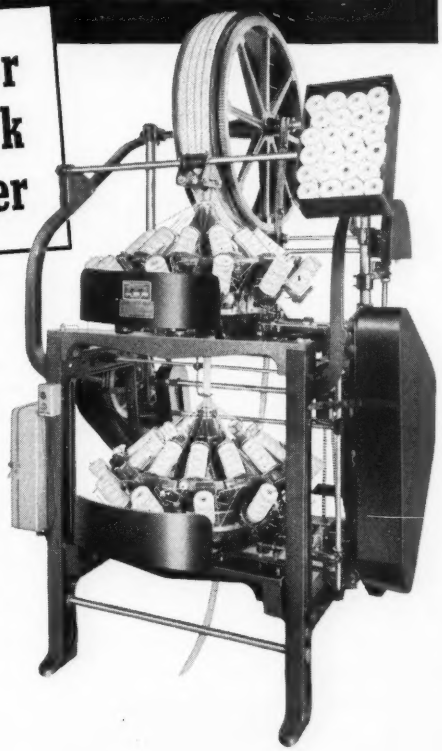
★ ★ ★

GSA is locating our new responsibilities in our regular stockpile organization because of the intimate relationship between the two programs. For two years the DMPA did a commendable job of widening the production horizon for scarce metals and minerals. There definitely was need for a separate agency during this time.

★ ★ ★

THE NEW "WARDWELLIAN"®

24-24 Carrier Double Deck Cable Braider



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Technical Service Data Sheet

Subject: EFFICIENT PICKLING WITH RODINE®

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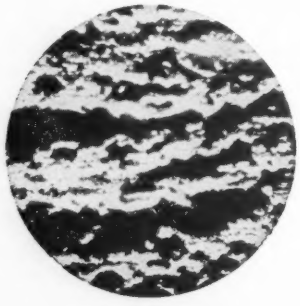

◀ *This steel surface was pickled in an uninhibited acid bath. Note the deep pits, and that the surface is visibly crystalline.*

This surface was pickled exactly like the one above except that "RODINE" was added to the acid solution. Only scale pockets and roll marks are visible; no pitting occurred. ▶

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The Materials Division's head will be **Irving Gumbel,** who had been Acting Deputy Administrator of DMPA. The Division will be under the general supervision of Emergency Procurement Service Commissioner **A. J. Walsh.**

New Forms to be Used for Government Purchasing

Further simplification of the paper work required in making Government purchases has been announced by Edmund F. Mansure, Administrator of General Services.

★ ★ ★

In a Regulation addressed to the heads of all Federal agencies, Mr. Mansure prescribed use of a new, simple form to handle the ordering of materials, certifying their receipt and okaying bills for payment.

★ ★ ★

A six-copy form will be standard throughout the Government, replacing nearly 50 different systems now in effect. Some of these require filling out anywhere from 8 to 23 copies.

★ ★ ★

"Although it is impossible for us to say exactly how much money the simplification is going to save," Mr. Mansure said, "a look at some costs gives an idea. For example, the Hoover Commission Task Force Report on the Federal Supply System in 1949 said that it costs a minimum of $10 to handle a Government purchase transaction.

★ ★ ★

"We know that the Government made more than six million individual purchasing transactions in Fiscal Year 1952. Assuming approximately the same number in the coming year, we think the new form now being adopted will cut the actual number of pieces of paper which have to be handled by almost fifty per cent.

★ ★ ★

"While we do not expect costs to be halved—because of various fixed charges—we know they will be substantially reduced. The same number of personnel will be able

to handle more transactions and handle them faster. Liability to error will be lessened. Even the actual number of filing cabinets needed to house the millions of individual pieces of paper will be sharply reduced as to reflect in lowered costs."

★ ★ ★

Created after exhaustive study, the new form is designed to accommodate agency requirements in almost all cases where purchases are made against existing contracts. Where no contract exists, the form can be used as an order for purchases up to $500. The Department of Defense and GSA itself may use the form in such instances for purchases up to $1000.

★ ★ ★

The new form will go into effect on October 30, 1953. Between now and that date, agencies will use up their stocks of existing forms.

★ ★ ★

The new document, known as Standard Form 147, is another step in GSA's efforts to make inroads in the complexity of paperwork surrounding buying.

New Government Organization Manual

Publication of the 1953-54 edition of the "United States Government Organization Manual" — a Government best seller—has been announced by the General Services Administration.

★ ★ ★

The revised Manual, which reflects the organization of the Federal Government as of July 1, 1953, includes the new Department of Health, Education, and Welfare and many other changes made pursuant to the President's Reorganization Plans of 1953. It also includes the names and titles of approximately 3,500 key officials.

★ ★ ★

A section outlining brief histories of all Federal agencies whose functions have been abolished or transferred since March 4, 1933, appears as Appendix A.

★ ★ ★

1 GREATER SALES APPEAL!

Gray Soldura gives the buyer visible evidence that the flameproof compound on non-metallic sheathed cable and service entrance cable is completely sealed and covered. Moreover, it camouflages service entrance cable used on white houses and forms an excellent base for the subsequent application of house paint.

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Gray Soldura *looks* cleaner because it *is* cleaner. It's used with a clear wax top dressing (which makes it easier to pull through joists or fish through conduits) and will not mark up walls during installation. Workmen's hands stay cleaner, too.

3 PROTECTS against STICKING!

Actual laboratory tests have shown that gray Soldura, applied with a proper saturant and finish, will prevent sticking at temperatures as high as 140°F. and will not flake off under freezing conditions.

FOR GREATER SALES APPEAL... FOR CLEANER APPEARANCE, EASIER HANDLING, AND FREEDOM FROM STICKING OR FLAKING... USE SOLDURA... THE GRAY WIRE COLOR SOLUTION THAT BUILDS SALES.

SPECIFICATIONS*

Weight per gallon	15-16 lbs.
Total solids	75-80%
Viscosity, Gardner Mobilometer @ 77°F., 250 grams load	15-20 seconds
Estimated coverage—Sq. Ft. per gal.	1250-1500
Number of coats recommended	Two, for best results
Colors	Light, medium and dark gray

**Gray Soldura is soluble in alcohol, acetone, and common lacquer solvents, but is not soluble in gasoline and petroleum solvents.*

FOR SPECIFIC INFORMATION ABOUT GRAY SOLDURA MS-551 AND A COMPLETE REPORT ON OUR LABORATORY TEMPERATURE TESTS, WRITE TO SOLAR COMPOUNDS CORPORATION.

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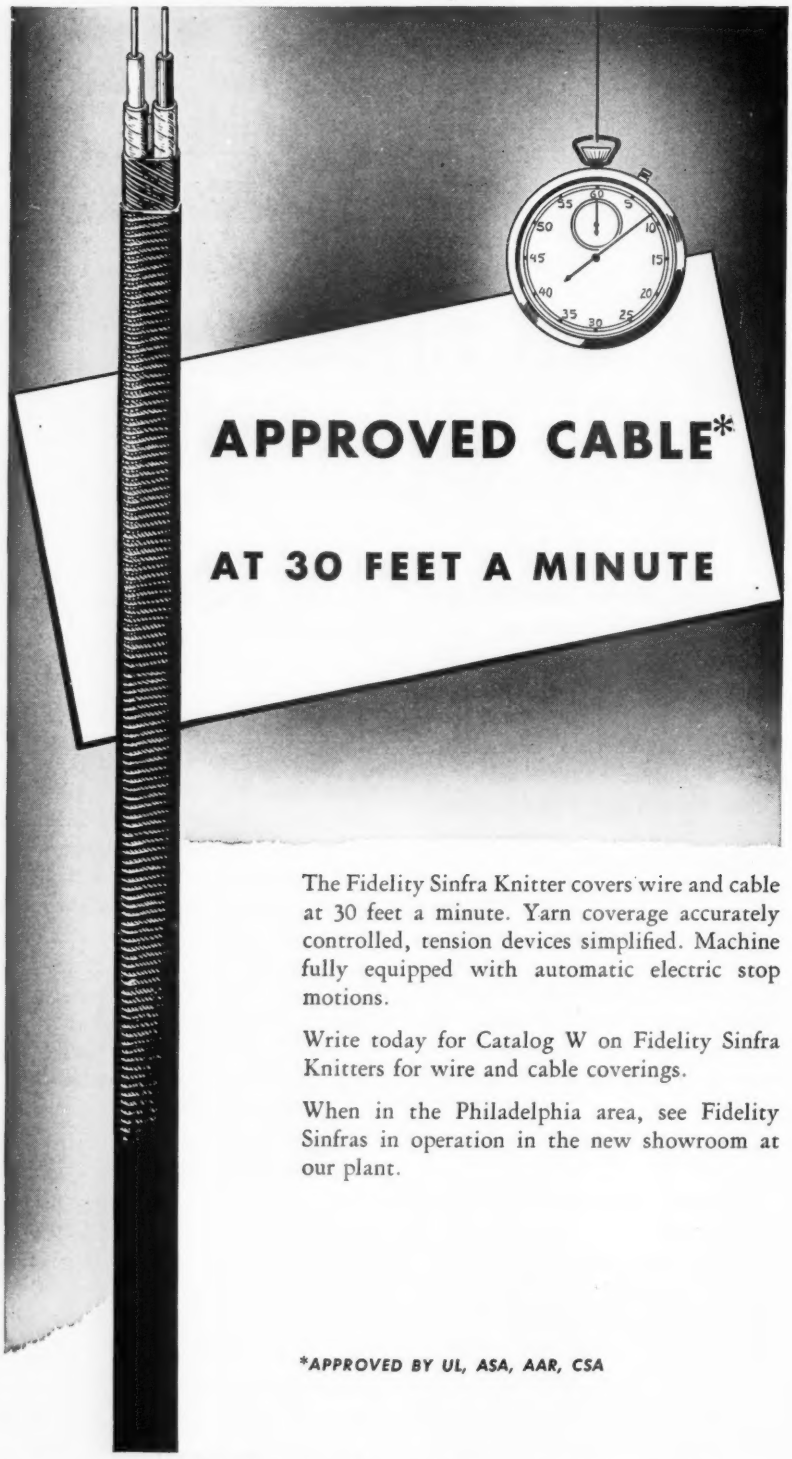

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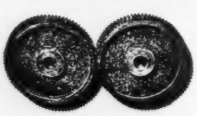

3908-18 FRANKFORD AVENUE, PHILADELPHIA, PA.

In the revised Manual may be found the answers to many questions that arise daily in Washington and throughout the Nation—questions such as, What is the name of the newest department in the Executive Branch of the Government? How was it established? What are the names of the members of the President's Cabinet, the Secretary of the Navy, the Army, the Air Force? Is the National Security Resources Board still in existence? What are the new functions of the Office of Defense Mobilization?

★ ★ ★

As the official organization handbook of the Federal Government, the 734-page Manual contains sections on the legislative, judicial, and executive branches. The descriptive material outlines the legislative authority, purpose, functions, and activities of each agency, and includes 34 charts showing the organization of Congress, the executive departments, and the larger independent agencies as of July 1.

★ ★ ★

The Manual is one of the 5 best sellers published by the Government. Compiled by the Federal Register Division of the National Archives and Records Service, General Services Administration, the Manual may be purchased for $1.00 a copy from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

New Contract for Lake Copper Signed

A contract designed to yield 7,965,000 pounds of refined copper for delivery to the Government has been signed with the Copper Range Company of Boston, Massachusetts.

★ ★ ★

The agreement provides that the company will produce ore from its "high cost" Champion Mine, located at Painesdale in Houghton County, Michigan, and will arrange with a qualified smelter to process the ore.

★ ★ ★

The Government will pay 32

cents per pound Connecticut Valley, less a differential of one cent per pound for all deliveries made common carrier's conveyance, refiner's plant.

★ ★ ★

Terms of the agreement call for production of 1,593,000 pounds in calendar year 1953 and 3,186,000 pounds annually in 1954 and 1955. The agreement automatically ends December 31, 1955 or earlier if the full production has been achieved.

★ ★ ★

On March 18, 1952, the Government signed an agreement with the same company for production at Champion of up to 6,372,000 pounds of prime lake copper which, due to high cost factors, was to be supported at a price of 33.8 cents per pound. That agreement terminated automatically when copper was removed from price controls on February 25, 1953. At that time almost 1,500,000 pounds had been produced.

★ ★ ★

Since the termination date of the previous contract, the company has been operating the mine without a Government contract but cannot continue to do so without an arrangement such as was announced today. A determination on the part of the Government that it is necessary to insure the continued production of copper for defense needs resulted in the current contract.

Wire Association papers received too late for publishing in this issue will be published in the November and December issues of WIRE AND WIRE PRODUCTS.

High Speed Precision Straightener For Wire As Small As .007"!

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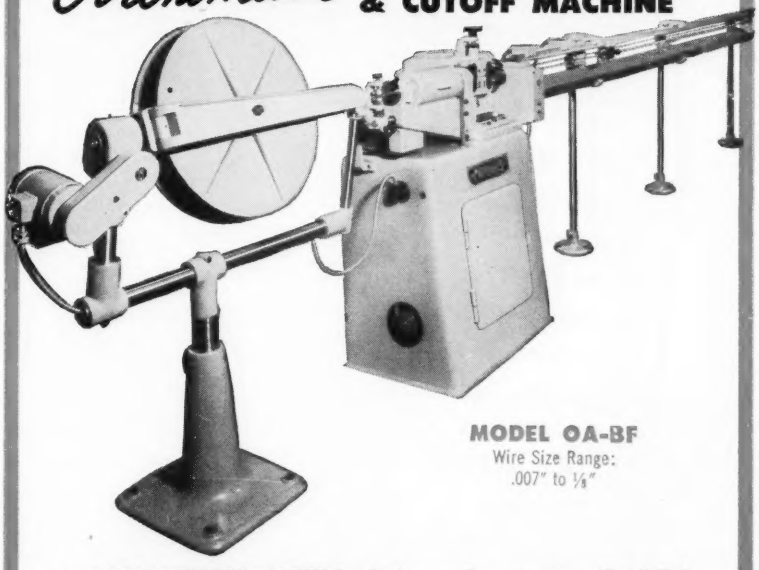
Minimatic WIRE STRAIGHTENING & CUTOFF MACHINE



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Wire Size Range:
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- *COMPLETELY NEW* in design and operation, the Minimatic establishes far higher than usual standard for economy, accuracy and speed in the straightening of small round wire.
- Fully automatic and self-feeding after coil is started into machine. Full vision push button control panel.
- Entire coil is straightened and cut without attention from operator. Disc-type cutoff, with only 2 moving parts, is electronically operated. Protects against swelling and expansion of wire ends.
- Adjustable rotary die straightening mechanism insures maximum precision for any size wire within range of machine.
- Floor space 7' 4" x 2' 0" plus length of runout section. Requires only 2 H.P.
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- ☐ Cable
- ☐ Car Seal
- ☐ Core
- ☐ Cotter Pin
- ☐ Covering
- ☐ CurtainSpring
- ☐ Drapery Pin
- ☐ Flexible Shaft
- ☐ Florist
- ☐ Fuse
- ☐ Glass Netting
- ☐ Hair Pin
- ☐ Holly
- ☐ Hook & Eye
- ☐ Lock Spring
- ☐ Piano Covering
- ☐ Picture Cord
- ☐ Pin
- ☐ Piston Ring
- ☐ Plow Steel
- ☐ Reed
- ☐ Rope
- ☐ Safety Pin
- ☐ Shaft
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ABSTRACTS

MACHINE FOR POLISHING TUNGSTEN-CARBIDE DIES.
Dykrex Corp of Am, Newark, NJ. Machinery (NY) 1953 Vol 59 (8) p 222 (Apr).

Machine for polishing and refinishing tungsten carbide dies permits instant change-over from automatic to manual or semi-automatic operation, from one job to another. Very fine finish claimed.

★ ★ ★

CHECKING WIRE DRAWING DIES
Longworth Sci Instr Co Ltd, Abingdon, Berks. Met Ind 1953 Vol 82 (21) pp 417-418 (May 22).

BISRA Profiloscope is based on principle of narrowly divergent light beam passing through die placed on tilting table, onto screen below. When die is horizontal, small bright circle of light appears inside dark band, which is inside narrow light band. Innermost circle is due to direct illumination through die hole, outer to internal reflexion from tapered die region. Changes in taper appear as more concentric light circles, gradual changes causing wider light band; scoring shows as light radial lines, intensified by tilting die. Die angle also measured by tilting die, permitting rapid quality control of die profiles. Accuracy of instrument 0.5 deg. Mathematical theory of Profiloscope discussed. 4 illustr.

★ ★ ★

GERAET ZUM AUFZEICHNEN VON DUESENKANAELEN. INSTRUMENTS FOR DRAWING DIE PROFILES.
F. Stapelfeldt. Aus Forschung und Produktion (Techn reports issued on 80th Anniversary of Deutsche Gold- & Silber Scheideanstalt), Degussa, Frankfurt am Main 1953 pp 391-394 (In German).

Description of simple optical instrument for tracing shape of die profiles by contact probe. 4 illustr.

★ ★ ★

KEEPING 'BATTLE' LINES OPEN
Anon. Texas Law Rev 1953 pp 9-11 (Apr).

'Spiral-Four' cable for use in Korea made at US Army Signal Corp Engg Lab, Fort Monmouth. Cable conductors consist of copper wire covered with carbon-impregnated textile tape over polyethylene insulation. Sixteen strands of austenitic stainless steel (18% chromlum, 8% nickel) wire braided around cable core. Steel wire has tensile strength over 300,000 lb/sq in.; drawn through diamond dies mounted in Monel inserts which resist wear and corrosive lubricant. Use of cable in oil and mining exploration anticipated. 7 illustr.

★ ★ ★

COLD DRAWING OF THORIUM WIRE
H. A. Saller, J. R. Keeler, R. J. Donley, C. D. Graham. Battelle Mem Inst 1953 (AECD-3507; BMI-704) 12 pp (Mar 3); Nuclear Sci Abstr 1953 Vol 7 (10) p 342 (May 31).

Various lubricants investigated. Wire as small as 0.005 in. dia drawn by enclosing Th in Cu jacket.

★ ★ ★

THE EVALUATION OF DRAWING LUBRICANTS.
W. J. Wojtowicz. Lubr Engg 1953 Vol 9

p 19-21 (Feb); Battelle Techn Rev 1953 Vol 2 (5) p 198a (May).

★ ★ ★

WIRE DRAWING DIES: BISRA PROFILOSCOPE FOR CHECKING TAPER AND WEAR.
Anon. Iron & Steel 1953 Vol 26 (7) pp 308, 320 (June); Wire Ind 1953 Vol 20 (234) pp 589-591 (June).
9 illustr.

★ ★ ★

SOME INVESTIGATIONS ON WIRE PULLING.
F. C. Thompson Berg—and Hüttenmännische Monatshefte, 98, Feb. 1953, p 21.

★ ★ ★

STEEL WIRE—GERMAN BOOK (STAHLDRAHT).
A. Pomp Verlag Stahleisen, Düsselldorf, Germany.

★ ★ ★

REASONS FOR SURFACE DEFECTS IN HOT WORKING PLAIN CARBON STEELS.
Herbert Buchholtz and Richard Pusch Stahl u. Eisen, v 73, Feb. 12, 1953, p 204-212.
Describes scaling tests using specimens taken from pickled rounds.

★ ★ ★

CHOICE OF STEELS SUITABLE FOR AUSTEMPERING.
E. Theiss Stahl u Eisen, v 73, March 12, 1953, p. 347.

★ ★ ★

THE WIRE-DRAWING OF METALS.
M. Bonzel (Metaux, Corrosion-Ind., 1952, 27, (320), 143-149).
B. describes the mechanism of flow through the die, the stresses involved, energy requirements, die forms, tests of drawability, and details of practice.

★ ★ ★

A NOTE ON THE BACK-PULL FACTOR IN STRIP-DRAWING.
R. Hill (J. Mechanics Physics Solids, 1953, 1, (2), 142-145).
The results of a recent paper by Green and H. (ibid., 1952, 1, (1), 31; M.A., 20 377) are extended to the case where back-tension is applied. The conclusions show that values of the die pressure obtained differ appreciably from those given by other current theories, particularly when the reduction or coeff. of friction is large.

★ ★ ★

LUBRICANTS FOR DRAWING METALS.
A. A. Brown (Reilly-Whiteman-Walton Co). Iron & Steel Eng 1953 Vol 30 (6) pp 96-104 (June)
General consideration of requirements. In discussion, D. E. Whitehead (Crucible Steel Co.), said that increasing use of diamond dies for drawing alloy steel wire brought new requirements in lubricants to permit successful drawing and economical die life. Reactive lubricant appears necessary for this type of work to prevent welding between alloy steel wire and diamond die.

★ ★ ★

KOMPLETTE ANLAGE ZUR HERSTELLUNG VON LOETDRAEHTEN. COMPLETE PLANT FOR PRODUCTION OF SOLDERED WIRES.
K. Drechsler. Draht 1953 Vol 4 (6) pp 227-229 (June) (In German)

a name that has stood for sturdy, dependable yarn beams in the Textile Industry for over 20 years . . .

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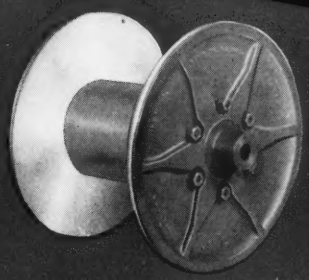

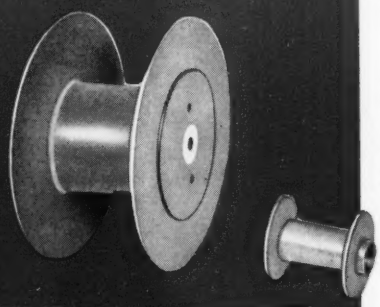

HEAVY DUTY REEL

Shown at left is one of several wire rope or cable reels designed and manufactured over the past several years to meet the heavy duty service of a wire rope manufacturer. Flanges with rope brake rim grooves are heavily ribbed semi-steel castings.

WELDED STEEL REEL

At left is one of several welded reels made to wire rope manufacturers' specifications for replacement of light weight pressed steel reels which failed to hold up under heavy duty service.

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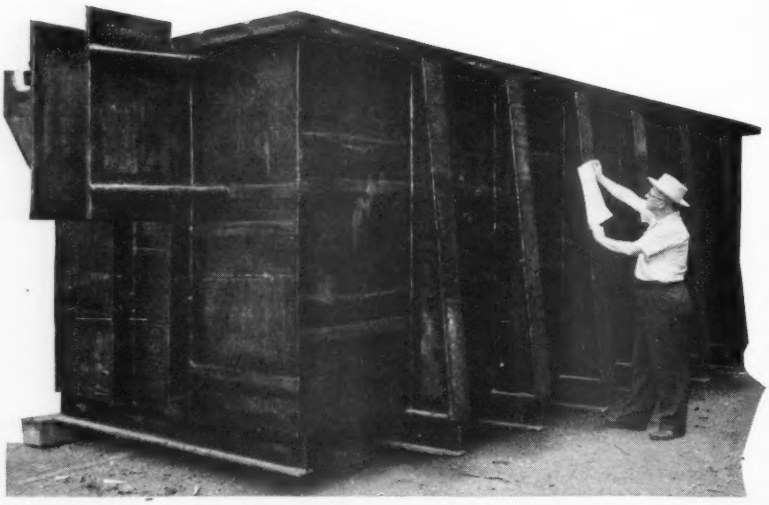

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Knight-Ware Wire, and Sheet Rolls or Sinkers Are Made to Fit Your Operations.

Among the necessary equipment a hand polishing machine for maintenance of drawing dies is mentioned. Spindle runs in 2 ball bearings; equipped with 3-jaw chuck. Drive by ¼ hp. motor. Drawing dies produced of chromium steel with high chromium content and hardness of 65 RC. 5 illustr.

APPROXIMATE CALCULATION FORMULA OF DRAWING FORCE BY CURVED SURFACE DIE.
H. Ogawa. Japan Soc Mech Engs Trans 1952 Vol 18 (65) pp 71-83; Japan Sci Rev (Engg Sci) 1952 Vol 3 (1) pp 8-9 (Dec) (In English.)

Two reports, MC-17 and MC-18. Established that ideal die shape for min drawing force exists; determined only by friction coeff between material and die wall, regardless of area-reduction ratio. In MC-18, force of drawing low carbon steel through 4 different dies described. Soap and lime water as lubricant; drawing area reduction 75 to 90%. Measured and calc values coincided well.

★ ★ ★

DIE PRESSURE IN PLANE STRAIN DRAWING: COMPARISON OF EXPERIMENT WITH THEORY.
J. G. Wistreich (Brit Iron & Steel Res Assoc). Journ Mech & Phys Solids 1953 Vol 1 (3) pp 164-171 (Apr).

Discusses theories relating to problem of drawing ideal solid of mathematical theory of plasticity through wedge-shaped die in plane strain. In that of R. Hill and S. J. Tupper, amplified by A. P. Green, die pressure at particular distance from die entry depends on distance, die angle and total die reduction. If length of die face does not exceed thickness of outgoing strip, pressure is constant along die, value varying with angle and reduction. For other proportions of reduction zone, pressure remains constant over parts of die face, varying elsewhere. Pressure may exceed yield stress by up to 2 ×. Theory contrasts with earlier ones, eg by G. Sachs, 1927, which it supersedes. Friction reduces pressure, but if slight and die short compared with stock thickness, effect is negligible. Experimental pressure curves of P. M. Cook and J. G. Wistreich resemble Hill-Tupper-Green curves in vital particulars, dissimilarities being consistent with idea that characteristic theoretical deformation pattern, determined by die geometry, is substantially preserved in work-hardening metal. Validity of correction for work hardening remains open question. 5 illustr, 8 ref, 2 tables.

★ ★ ★

TEMPERATURE EFFECT ON THE STEEL WIRE DRAWING.
A. Yamamoto, S. Tanaka, S. Kataoka. Japan Soc Mech Engs Trans 1952 Vol 18 (65) pp 97-103; Japan Sci Rev (Engg Sci) 1952 Vol 3 (1) p 9 (Dec) (In English.)

Steel wire drawn at various temp from room temp up to 600 deg C. Wire protected from oxidation. Three zones defined: room temp zone, blue brittleness temp zone, and recrystallizing temp zone, properties of wire vary with zone.

★ ★ ★

STUDY OF THE STRUCTURE OF VERY FINE COPPER WIRES, 0.15-0.02 MM DIAMETER.
F. Erdmann-Jesnitzer, M. May. Metall 1953 Vol 7 (7/8) pp 250-254 (Apr);

BNFMRA Bull 1953 Vol 33 (288) p 235 (June) (Original in German.)

★ ★ ★

DIE TECHNISCHE ENTWICKLUNG DER NADELHERSTELLUNG. TECHNICAL DEVELOPMENTS IN THE PRODUCTION OF NEEDLES.
F. B. Schmetz, E. G. Haase. Stahl & Eisen 1953 Vol 73 (14) pp 908-914 (July 2) (In German.)
The first needles; needle production of the Middle Ages first machine for making needles; needle manufacture up to 1900; stages in production of sewing machine needles. 12 illustr.

★ ★ ★

DIE ARBEIT DES DNA IM JAHR 1952. THE WORK OF THE GERMAN STANDARDS INSTITUTION DURING 1952.
Prof Dr-Ing Zinzen. DIN-Mitt 1953 Vol 32 (6) pp 163-168 (June 1) (In German.)
Among others, mentioned that draft standard on diamond drawing dies prepared. Also, new standards on sieves issued. 2 ref.

Research Developments on Wire In England

The British Iron and Steel Research Association, 11 Park Lane, London W 1, in its annual report for 1952, gives the reports of its several committees, among which is one by the Drawing Committee.

★ ★ ★

This one committee's summary of its work during the preceding year is quoted below.

MECHANICS OF DRAWING

The photo-elastic measurement of die pressure in plane-strain drawing is now complete. This is principally of interest in connection with the Hill-Tupper theory of drawing, but may also be of practical use in drawing electrical conductor strip. The experiments have shown that the Sachs theory of drawing does not give such an adequate explanation of the die pressure as the Hill-Tupper theory, and that the die pressure exceeds the yield stress of the stock in light reductions through dies with large angles and is, in general, greatest at the die exit.

Although the above-mentioned Hill-Tupper theory deals only with plane-strain drawing, it may be assumed, by analogy with the findings mentioned above, that the Sachs theory is unsatisfactory for drawing through a round die. Experiments on drawing copper wire through a split steel die lubricated with soap are complete. The analysis of the results has only just begun but it is already apparent that again pressures greater than the yield stress may occur.

HOT STRETCHING

The first experiments on the hot stretching method of making wire without dies did not show any upper limit to the reduction in size possible but, in practice, the wire broke at moderate reductions. Later tests with mild steel and stainless steel wires indicated that it would be difficult to produce wire of

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uniform diameter if flame or electrical resistance methods were used to heat the wire. Experiments with induction heating were more promising and it was found that 12 SWG mild steel wire could be reduced continuously by 50 per cent. to within ± 0.001 in. In short runs reductions of 60 per cent. or more were attained and output speeds varying between 20 and 50 ft./min. had no effect on the machine's performance. There was no evidence of internal flaws and, when the stretched wire was processed further, the product was indistinguishable from conventionally produced wire.

The experiments have shown that continuous and steady stretching of mild steel wire is technically feasible on an industrial scale, but the margin between steady running and fracture is lower than in wire drawing, and it is probable that hot stretching will not be of practical commercial interest at present. Nevertheless, particular applications may be found for it where hot wire is available at an intermediate stage of production.

PROPERTIES OF WIRE

The effect of drawing on the properties of high tensile wire is being studied. The stress-strain curve of such wire has been explored in detail, particularly the initial part, for it is believed that the departure from Hooke's law in what is usually regarded as the elastic range is significant in the subsequent behavior of the wire in service as rope. In the preliminary experiments it was thought desirable to determine any effects of drafting procedure separately from the known effects of temperature. The tests were therefore carried out at slow speeds. It appeared that whereas the ultimate tensile strength of wire was fairly insensitive to the number of passes taken to achieve a given total reduction, the percentage uniform elongation of wire lightly drafted at each pass was much greater than that of wire heavily drafted at each pass. The proof stress was substantially lower in the lightly drafted wire. Further experiments will be carried out at higher speeds to study the combined effects of temperature and drafting.

DIES

Works trials have shown that cleaning of the wire before drawing and not the die material is the main cause of variability in die performance. Furthermore, the B.I.S.R.A. Profilometer has revealed that die profiles vary much more than was hitherto supposed and this may be a contributory factor. As a result of these findings, it has been decided to stop the study of abrasion resistance of die materials and to concentrate instead on the cleaning, coating and lubrication of wire.

The B.I.S.R.A. Profilometer is a research and a master inspection tool and is not suitable for routine inspection in the die shop, where a cheaper and less accurate instrument which is quicker to operate and more easily handled is needed. A new instrument, known as the "Profiloscope," has been designed at Sheffield to fulfil these requirements. With this instrument a picture of the inside of a die is shown and the die angle may be easily measured.

Nothing finer!

A statement from
a conservative organization:

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LUBRICATION

Research into lubrication in wire drawing has begun. The term "lubrication" is here used to include cleaning and coating, for these two processes are inseparable in their effects from lubrication proper, and great economic advantages could be gained by combining the three into one treatment.

Some preliminary work has been done at low speeds and the findings are therefore not immediately applicable to works practice. However, it has been shown that some phenomena in wire drawing can be explained from the results of recent research into the mechanisms of friction and boundary lubrication.

Various aspects of lubrication to be studied include methods of assessing lubrication and the completion of scale removal in pickling, the deposition of solid lubricants on the wire surface, and the chemical conversion of mill or annealing scale into a coating which will assist lubrication.

ASTM Accepts 63 New Materials Specifications

At the 1953 Annual Meeting of the American Society for Testing Materials, held June 28-July 3 at Atlantic City, seventy-two of the Society's technical committees reported, with the result that 63 new specifications and tests were approved. All of these new tentatives will be published later in the year in the 1953 Supplement to the Book of ASTM Standards.

★ ★ ★

The specifications adopted included those for: Stainless Steel Wire Strand (A 368-53T); Wire for Electrical Conductors (B-1); Method of Test for Stiffness of Bare Soft Square and Rectangular Copper Wire for Magnet Wire Fabrication (B 279-53T); and Recommended Practice for Preparation of Copper and Copper-Base Alloys for Electroplating (B 281-53T).

★ ★ ★

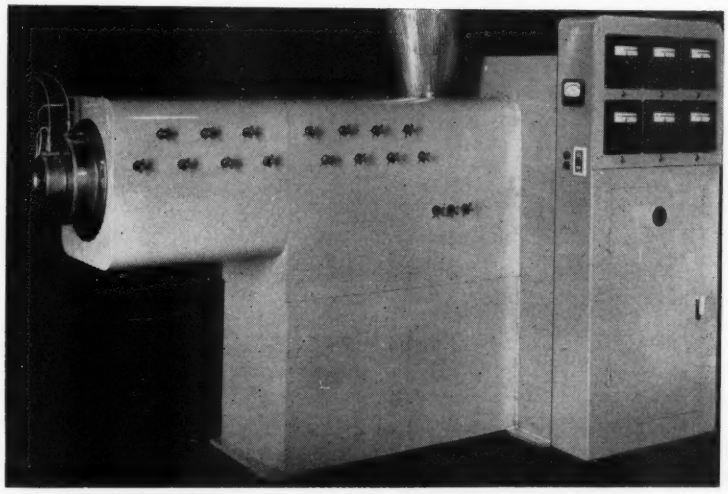
Copies of the specifications will be available from ASTM Headquarters at 1916 Race St., Philadelphia 3, Pa., when published. A nominal charge, usually 25 cents, is made for standards of 16 pages or less.

More Wire Products for the West

Achievement of high production rates on western produced wire products until recently has been handicapped by lack of adequate automatic wire forming machinery. And the market for a steadily growing variety of wire items pro-

"Modern" EXTRUDING EQUIPMENT

is designed for those electric wire manufacturers who demand the best in extruders



MPM Model No. 450 Silent Chain Drive Extruder

MPM Extruders are used by nearly all material suppliers, by laboratories for quality testing, and for production. One large electric wire manufacturer now has 17 MPM extruders—reorders for them indicate the satisfaction they give.

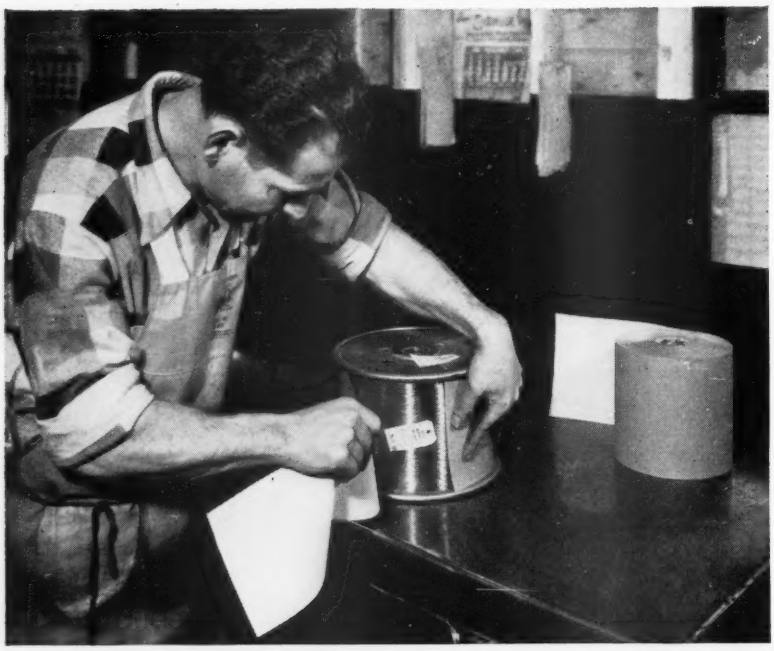
MPM Extruders have the utmost flexibility and will handle a wide range of compounds and cross sections and are equipped with the best in temperature controls.

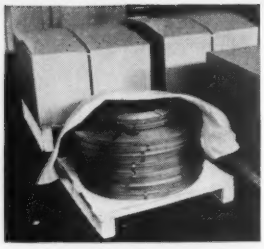
When sending inquiries, please include all available details of your requirements as to production, materials to be extruded and electric current characteristics. We can then suggest the equipment best suited to your purpose. Made for round or flat wire and for tubing.

MODERN PLASTIC MACHINERY CORP.

15 UNION STREET

LODI, NEW JERSEY, U.S.A.





VPI shroud — no oil or goo used.

Angier VPI peripheral wrap

VPI Wrap used as an insert.

Vapor from paper
STOPS RUST

Simple as it seems, this Angier paper is merely placed near metal to *prevent rust*. It gives off a vapor that makes air and moisture harmless to steel.

Angier VPI® Wrap makes coating with oil or goo a needless chore. All "cleaning" costs are saved. Metal stored or shipped with VPI always is ready for instant use . . . what *sales appeal* for your products! Rejects due to rust are eliminated.

If *your* products must be guarded from rust (for days or *years*) send the coupon now for facts.

Angier

DISTRIBUTORS IN PRINCIPAL CITIES

The Most Experienced Name in Vapor Rust Preventives

Angier Corp., Framingham 3, Mass.

Name .....

Title .....

(Clip this to your letterhead)

( ) Send "VPI Facts" as applied to shipping or storing wire and steel.

( ) Send facts on Angier spiral wrapping machines.

duced west of the Rockies is expanding rapidly. To meet present and anticipated future western growth, Melco Wire Products Co., Los Angeles, Calif., has installed three new automatic four-slide wire forming machines.

★ ★ ★

This equipment in only a single operation now can do the work heretofore performed in three or more separate operations, many of them by hand or in combination with small machines such as press brakes and punch presses.

★ ★ ★

Production of wire products, from pants hangers to display racks and novelty wire-wheeled metal stagecoach bodies for ceramic artware, is now possible at one-fourth the cost of former methods on a volume basis. Production rates in excess of 5000 wire items per hour have been achieved, by the use of the largest Baird four-slide wire forming machine west of Chicago.

★ ★ ★

Wire—flat, round, half-round, or square—is presently rolling out of western steel producing mills such as USS-Columbia Geneva Div. and Bethlehem Pacific at a record pace. More of these manufacturers' wire will be going into the hundreds of proprietory and jobber-produced items now being developed and sold in and for the west.

★ ★ ★

Melco Wire Products is headed by 38-year-old **Melvin J. David,** who started the firm shortly after World War II. It now employs 15 and has an annual volume of $250,000. With automatic equipment this volume is expected to double in the next two years, according to Mr. David, who forecasts that much more of the wire product jobbing production in the next few years will be firmly entrenched in the west, rather than the east, which until now alone boasted this competitive automatic machinery.

Packaged-Drive Booklet Available From Westinghouse

Packaged adjustable - voltage drives for variable speed applications are covered in a 16-page book-

let available from the Westinghouse Electric Corporation. The first of its kind, this booklet gives complete information about this adjustable voltage drive: construction and operation, typical applications, and the economics of operation are discussed.

★ ★ ★

Special operational characteristics that can be added to the standard package—such as inching, reversing, dynamic braking and multi-motor control—are described, and case histories of these AV drives in the machine tool, textile, and continuous processing industries are cited.

★ ★ ★

For a copy of this booklet, B-5808, write Westinghouse Electric Corporation, Box 2099, Pittsburgh 30, Pennsylvania.

Booklet Describes New Nylon Covered Wire Rope

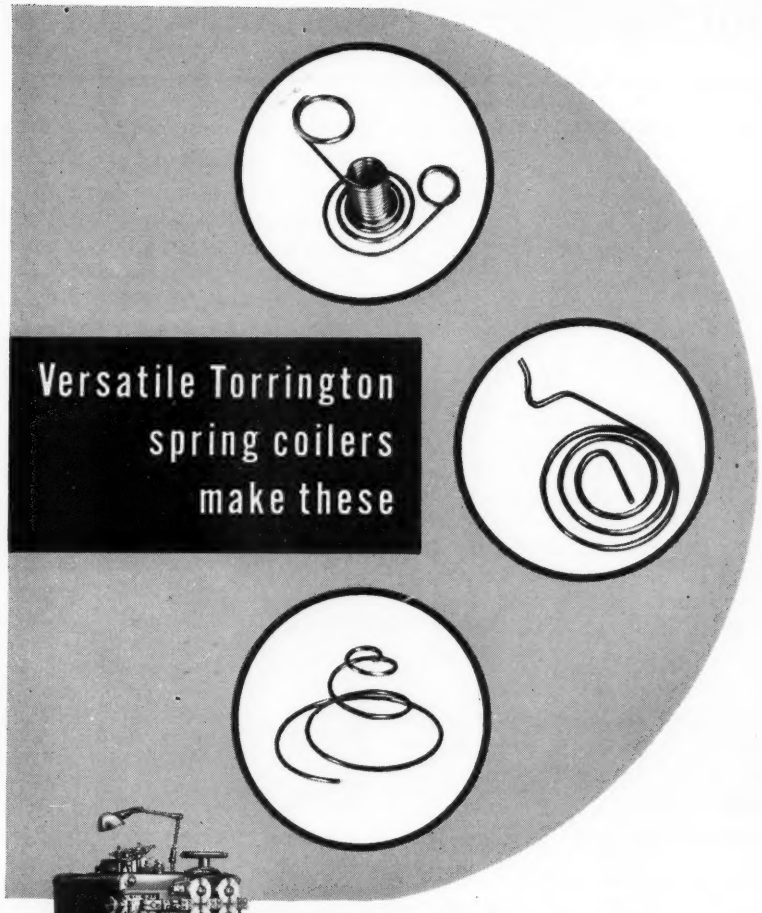
An unusual type of booklet describing the properties and qualities of "Wirelon" ropes has just been published by **Rochester Ropes, Inc.,** Culpeper, Virginia, who make this unique and useful addition to a large family of ropes, cords and cables.

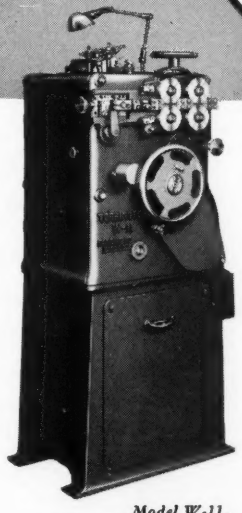
★ ★ ★

Constructed of high tensile steel strands and tough, durable nylon, Wirelon is taking an important place in many industries and trades with its numerous special qualities. A high strength steel core of 250,000 p.s.i. tensile, gives Wirelon strength. A hard jacket of transparent nylon protects the core from corrosion and increases fatigue resistance up to five times. The nylon surface is smooth and cannot damage other materials it contacts, and the high electrical resistance of nylon prevents sparking and grounding where this hazard exists.

★ ★ ★

Wirelon is available in a complete range of sizes, strengths, and other physical characteristics, and has proved its superiority in a wide variety of uses. The booklet gives description and specifications.





Model W-11, one of fourteen versatile Torrington Spring Coilers

SPECIFICATIONS

Wire Diameter Range: .013" to .072"

Wire Length per Spring: 0" to 42" (Extra Wire Feed Gears Available)

Coil Range (O.D.): 3/32" to 1-9/16"

Production: 23 to 190 springs per minute with variable speed drive

Torsion and other attachments available.

PLUS an amazing range of other intricate springs that meet the most exacting requirements. Professional springmakers from coast to coast agree that a Torrington Spring Coiler can't be beat for speed, accuracy and economy. Your professional springmaker who owns a Torrington spring coiler can make springs to your special needs. If you're uncertain about a source of supply for a special spring you want, our sales department will help you find it or help your springmaker devise tooling to produce it.

The TORRINGTON MANUFACTURING COMPANY
TORRINGTON, CONNECTICUT

Outstanding Personalities of the Wire Industry

Made Assistant Sales Manager of Laclede

The appointment of **Warren L. Loveridge** of St. Louis as assistant sales manager of **Laclede Steel Company's** manufacturers' wire division has been announced.

★ ★ ★

Mr. Loveridge, a graduate of the Missouri School of Mines and Metallurgy at Rolla, Mo., joined Laclede in 1941. Except for two years with the Air Force in World War II, he has been continuously employed by Laclede, first as an assistant metallurgist and later in the sales department.

★ ★ ★

Headquarters for Laclede's sales department are in the company offices in the Arcade Building in St. Louis.

With Keystone Thirty-five Years

Henry Cordes (right) superintendent of the wire drawing department at Keystone Steel & Wire Company, receives a 35-year service pin from **John Sanderson,** superintendent of wire mills, during an informal ceremony recently at the company. Mr. Cordes started at Keystone in 1918 as a trucker in the galvanizing department.

C. F. & I. Executive Promoted

E. J. Byrnes, Jr. has been appointed Assistant General Manager of Sales, Eastern Division, of The Colorado Fuel and Iron Corporation, according to an announcement by **L. A. Watts,** General Manager of Sales, Eastern Division, C. F. & I.

★ ★ ★

In June, 1925, prior to the merger with C. F. & I., Mr. Byrnes joined the then Wickwire Spencer Steel Company as an administrative assistant in the Springs and Formed Wire Department, New York City. In 1938, he was made Assistant Product Manager of the Springs and Formed Wire Department and in 1940, he was promoted to the post of Product Sales Man-

Vitron
GLASS FIBER
TEXTILE YARNS
ELECTRICAL INSULATION • PLASTIC REINFORCEMENT • CURTAINS AND DRAPERIES
INDUSTRIAL AND DECORATIVE COATED FABRICS • PAPER SHEET AND TAPE REINFORCEMENT

Q. What process means *uniformity* in glass yarns and fabrics for superior quality glass-plastics products?

A. It's Electronic-Extrusion—the advanced process for glass fiber manufacture—developed, patented and used exclusively by Glass Fibers Inc.

This 8-page booklet will give you the "what" and the "why" on VITRON Glass Fiber Yarn from raw glass batch to finished package. The new glass fiber nomenclature, property tables, synthetic fiber comparison charts are all here too.

Glass Fibers Inc.
Dept. IM-352, 1810 Madison Ave.
Toledo 2, Ohio

Please send me your 8-page booklet on Vitron Glass Fiber Yarns.

Name .....

Company .....

Address .....

City ..... State .....

ager of the Springs and Formed Wire Department.

★ ★ ★

In 1944, the sales office for the Springs and Formed Wire Department was moved to the Morgan mill in Worcester, Mass., where it is located today. Mr. Byrnes will be located at the executive offices of the corporation in New York City after July 1st.

★ ★ ★

Mr. Byrnes is a director of the Spring Manufacturers Association. He was president of the association for five years, from 1946 to 1951.

Carpenter Steel Expands Company's West Coast Facilities

An open house commemorating the opening of a new mill-branch warehouse and office for the **Carpenter Steel Company** in the San Francisco Bay area was held recently at Belmont, Calif.

★ ★ ★

The new warehouse, located at 1530 Industrial Way in Belmont, was opened recently to keep pace with the rapid growth of the San Francisco Bay area and the Pacific Northwest. Combined with the company's large Los Angeles facilities, the new installation enables Carpenter to offer a more complete service and stock to West Coast users of tool, alloy and stainless steels.

★ ★ ★

D. J. O'Neil, Pacific Coast manager for Carpenter, is in charge of the Belmont warehouse and office. The salesmen working out of the Belmont headquarters are **M. J. Brown** and **K. C. Largent.**

Named Director of Purchases for Bohn Aluminum

Clifford J. Alpaugh has been named to the newly created position of director of purchases of Bohn Aluminum & Brass Corporation, Detroit, according to an announcement by S. D. Den Uyl, president.

★ ★ ★

Mr. Alpaugh comes to Bohn Aluminum from Federal Telephone & Radio Corporation where he also served as director of purchases. Prior to that he was associated in the same capacity with Toledo Scale Company. He has been active in the field of purchasing for many years.

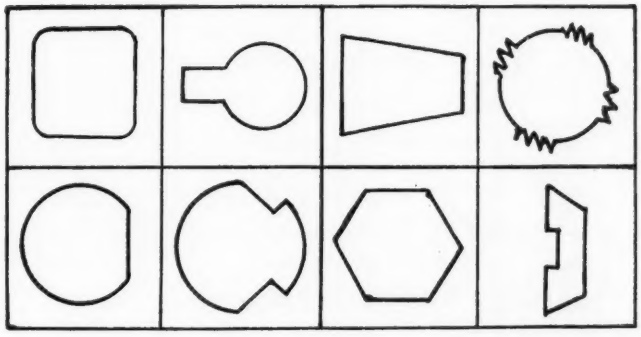
★ ★ ★

Previously he was associated with RCA Victor Division of Radio Corporation of America, Curtiss-Wright Corporation and International Business Machines Corporation.

Revere Elects Officers

Election of **James M. Kennedy** as chairman of the board and chief executive officer of **Revere Copper & Brass Inc.,** New York, and of **Charles A. Macfie** as president, succeeding Mr. Kennedy, was announced recently. **Raymond P. Winberg** was named general sales manager to succeed Mr. Macfie and **Robert M. Lake** became vice president in charge of the Rome, N. Y., division.

SHAPE DIES



These are just a few of the shapes of rod and wire drawn through UNION shape tungsten carbide dies. In the twenty-five years since UNION first pioneered tungsten carbide we have manufactured shape dies of every conceivable type, and all of that accumulated experience goes into every die we make today. For the finest shape dies at sensible prices, that familiar mark "UNWIDIE" is your answer.

UNION WIRE DIE CORP.

71 West 45th STREET
NEW YORK 19, N. Y.

Main Plant
375 Fairfield Ave.
Stamford, Conn.

Affiliated with
La Filiere Union
Paris, France

Glass Fibers Appoints Sales Distributor

Stewart W. Schulmeyer has been appointed Manager, Electrical Sales of the Textile Division of **Glass Fibers, Inc.,** Toledo, Ohio, according to an announcement made by **R. W. Capaul,** Vice President and General Sales Manager. Mr. Schulmeyer had formerly been Service Manager at the Waterville plant of the company.

★ ★ ★

Previous to his employment with Glass Fibers Inc., he had been a project engineer in the aircraft division of Packard Motor Company. Mr. Schulmeyer had six years of service as an engineer in the Operation and Repair Section of the U. S. Navy and finished as a Lieutenant.

★ ★ ★

He is a chemical engineering graduate of the University of Michigan, class of 1943, a member of the American Society of Quality Control, Society of the Plastics Industry, and an Associate Member of the National Electrical Manufacturers' Association.

MUSIC and SPECIAL WIRES

Music Wire for Industrial Purposes:

211 sizes, Bright Polished, .0015" to .3125"

45 sizes, Bright Tinned, .003" to .125"

Special Wires

Aluminum—Annealed—Belt Lacing—Brass, Soft and Spring—Copper, Bare and Tinned

Coppered Steel Spring—Galvanized—Tinned

Monel—Nickel Silver—Pure Soft Nickel—Oil Tempered, Steel Spring, Black Finish

Phosphor Bronze, Spring Temper—Pure Iron Wire—Resistance Wire,

Hoskins Chromel "A"—Stainless, Soft and Spring Temper—Tag Wire, 1000 in an Envelope—Florist Wire—Spooled and Coiled, 1/4-1/2-1-5#

Wires Straightened and Cut to length—Small Gauges—

Small orders our specialty

Wires and Strands for the fishermen—Trolling Wires: Copper-Monel-Stainless.

Leader Wires: "Wilstabrite" Stainless and "Silverbrite" Music.

Send inquiries to

THE MALIN & COMPANY

2514 Vestry Ave. **Cleveland 13, Ohio**

Established in 1884

Elected Vice President of American Chain & Cable

Henry Ervin has been elected vice president-director of sales of American Chain & Cable Company, Inc., and associate companies.

★ ★ ★

Sales activities of the 16 divisions of the company will be under his direction from his headquarters at 230 Park Avenue, New York.

★ ★ ★

Mr. Ervin has been with the company since 1937 and for the past two years has been administrator, general sales. Prior to that he was district manager for American Chain Division in the New York district. He has been identified with the automotive and hardware industries for more than 30 years.

To Handle Sales of Wemco Pumps

Fisher Associates, 122 East 42nd Street, New York 17, N. Y., have been appointed by the **Wire Equipment Manufacturing Co.,** Trenton, N. J., to handle the distribution and sale of Wemco Molten Metal Pumps on an exclusive basis. These pumps are corrosion and heat resistant and are useful in emptying tanks of molten salts, metals and other materials.

Engineer Joins Carboloy

Eugene J. Lenar, formerly with Western Michigan Steel Foundry, Muskegon, Mich., joined the **Carboloy Department of General Electric Company** as an engineer in the metallurgical process and quality control unit for permanent magnet materials at the Edmore, Mich., plant. He is a metallurgical engineering graduate from Michigan State College.

Crescent Appoints New P.A.

The Crescent Company, Inc., Pawtucket, R. I., manufacturers of wire and cable, recently announced the appointment of **E. Oliver Hanson** as their new Purchasing Agent, effective September 14, 1953.

★ ★ ★

Mr. Hanson was graduated from the University of Alabama in 1935 with a Bachelor of Science Degree in Banking and Finance. He has served in the past, as Purchasing Agent for the Keeney Manufacturing Company and also for the Hartford Steel Ball Company. Recently, Mr. Hanson served as Director of the Connecticut Purchasing Agents Association. He has also been active in a number of civic associations in his home community of Windsor, Connecticut.

★ ★ ★

Mr. Hanson is currently working with **James Sanek,** Crescent's Purchasing Agent for the past ten years.

A S T M Elects Officers

The American Society for Testing Materials has announced the election of the following officers, each of whom was given official notice at the Society's Annual Meeting in Atlantic City late in June.

★ ★ ★

Leslie C. Beard, Jr., Asst. Director of Socony Vacuum Laboratories, New York, has been made President; Claire H. Fellows, Director, Engineering Laboratory and Research Dept., Detroit Edison Co., Detroit, is now Vice President; and Neil A. Fowler, Director of Sales and Research, General Box Co., Des Plaines, Ill., was elected to the Board of Directors; along with R. T. Kropf, Vice President, Industrial Thread Div., Belding Heminway, Corticelli, New York; T. E. Olt, Director, Research Laboratories, Armco Steel Corp., Middletown, J. R. Townsend, Director of Materials & Standards Engineering, Sandia Corp., Albuquerque, and K. B. Woods, Professor of Highway Engineering, Purdue University, Lafayette, Ind.

Named President of McInerney Spring and Wire Co.

James M. McInerney has been named president and **William K. McInerney** executive vice president of the McInerney Spring & Wire Company in Grand Rapids, Mich. They are sons of the founder, **James L. McInerney,** who has retired as president to become board chairman.

Rochester Office of Anaconda Transferred to Syracuse

The Rochester office of **Anaconda Wire & Cable Co.** will transfer to Syracuse, N. Y. on September 1st. The district office will occupy quarters in the Kemper Building, Room 701, and the telephone number will be Syracuse 2-0391.

★ ★ ★

Morse E. Galliett continues as district manager, assisted by Salesman **Bryn W. Waters.**

Glass Fibers Elects New Directors

At a recent meeting, J. Fred Hedding and Thomas A. Collins were elected to the Board of Directors of Glass Fibers Inc., Toledo, Ohio.

★ ★ ★

Mr. Collins, executive vice-president and general manager of the glass concern, joined the organization in August 1952 and was appointed general manager in January 1953. Before joining Glass Fibers, Mr. Collins had been in the

WIRE SPOOLS, ALL-STEEL, LITHOGRAPHED

Ends and traverses may be shipped separately and assembled easily in your plant on a hand, foot, or power press.
5" and 6½" diameter ends with 1-15/16" diameter traverses.
10½" diameter ends with 3½" diameter traverses.
Traverse lengths up to 12".

J. L. CLARK MANUFACTURING CO.
600 23rd AVENUE • ROCKFORD, ILLINOIS

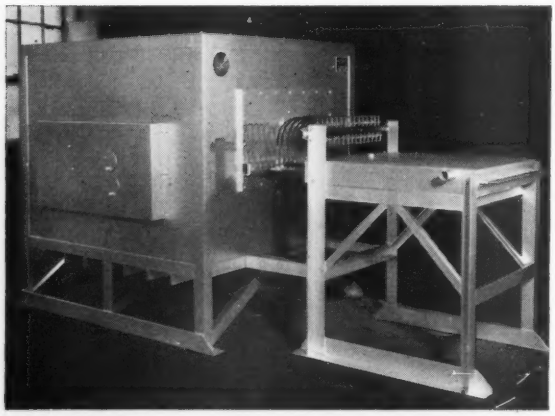
glass industry for twenty-six years, all of that time with Owens-Illinois Glass Company.

★ ★ ★

Mr. Hedding, engaged in the estate management business in Pittsburgh, is also a director of Diamond Alkali Company, Cleveland; Broderick and Bascom Rope Company, St. Louis and Firth Sterling, Inc., Pittsburgh.

Wire Co. of America Officers Reelected

At a recent meeting of the stockholders of the Wire Company of America, Los Angeles, the following officers were reelected for the ensuing year: President, **Bruce Cleveland;** vice president-general manager, **J. E. Harling;** secretary, **D. P. Whitacre,** and treasurer, **Richard C. Cleveland.**



HIGH PRODUCTION OF STAINLESS WIRE WITH HARPER STRAND ANNEALERS

One user reports the annealing of 597,272,000 feet of stainless wire in one year, operating 24 hours a day for two years.

AND NEVER A SIGN OF TROUBLE!

This efficient, trouble-free HARPER Furnace is a 30 tube atmosphere unit that maintains temperatures of from 2000° to 2200°F, with wire speed averaging 100 FPM. Softer wires run at slightly lower speeds. High uniformity of quality results.

Annealing with this HARPER FURNACE has practically eliminated rejections.

If you want low-cost continuous bright annealing, investigate HARPER FURNACES. They'll serve you well.

You are invited to consult HARPER Engineers on your wire problems. Address inquiries to

HARPER ELECTRIC FURNACE CORP.

Dept. 12, 32 River Street, Buffalo 2, New York

Designers and Builders of High Temperature Electric Furnaces.

Firth Sterling Appoints John P. Sweeney and Munro J. Mann

Firth Sterling, Inc. has announced the appointment of **John P. Sweeney** as District Manager, and **Munro J. Mann** as Assistant District Manager of the Detroit Branch. Mr. Sweeney succeeds **Gunther A. Jacobs.**

★ ★ ★

Mr. Jacobs, after 48 years of service with Firth Sterling requested that he be relieved of the managerial problems of the Detroit Office. He will continue as Vice-President of Firth Sterling and will be active in that area.

★ ★ ★

Mr. Sweeney came to Firth Sterling in April, 1950, as a salesman in the Detroit District. He has been a life long resident of Detroit except when he was in the navy, where he held the rank of commander. He was connected with the torpedo manufacturing program of Naval Ordnance.

★ ★ ★

Before coming with Firth Sterling, Mr. Sweeney was president of J & T Hurley Inc. for ten years, and was subsequently a manufacturer's representative handling industrial equipment. He attended Georgetown University and later graduated from the University of Detroit.

★ ★ ★

Mr. Mann has been a salesman for Firth Sterling in Detroit since April, 1947. Previously, he was with the Chrysler Corporation, Highland Park Plant for 23 years, where he rose through various positions in tool engineering to Chief Tool Supervisor.

★ ★ ★

Born in Canada, he attended the R. A. Parqueson Preparatory School in Toronto and the Detroit School of Technology. During World War I, he was a second lieutenant in the Royal Air Force. Mr. Mann, a United States Citizen, has spent his working life in Detroit where he is well known in industry.

★ ★ ★

Mr. Sweeney will be responsible for all the management functions of the Detroit Branch.

Rem-Cru's Expansion Brings New Executive Line-Up

The board of directors of Rem-Cru Titanium, Inc., Midland, Pa., leading producer of titanium, and jointly owned by Remington Arms Company, Inc., and Crucible Steel Company of America, has announced these changes in board membership and executive responsibilities:

★ ★ ★

C. K. Davis president and general manager of Remington Arms Company, Inc., formerly chairman of the board of directors, has been made honorary chairman of the board.

★ ★ ★

W. H. Colvin, president of Crucible Steel Company of America and former president of Rem-Cru, has been elected to chairman of the board of directors of Rem-Cru.

★ ★ ★

W. U. Reisinger, vice president and director of finance for Remington Arms was elected president. Mr. Reisinger was formerly treasurer of the company.

★ ★ ★

J. S. Hoffman, assistant treasurer of Remington Arms, was appointed treasurer of Rem-Cru.

★ ★ ★

During the past year the production of titanium has grown from small lots to production figures measured in tons. From the experimental phase, the titanium industry, expanded by leaps and bounds until now in 1953 the metal is available for many production applications.

★ ★ ★

As recently as a year ago, titanium could have been classed as a rare engineering metal such as were tantalum, molybdenum, tungsten and zirconium, but tremendous recent changes have been brought about in the production and processing of this middleweight champion of metals. Rem-Cru pioneered the field with the first two-ton ingots, and now continuous wide-strip processing is a reality. New quality controls have been established and production applications have been put in service in aviation and allied industries.

★ ★ ★

Continued experimental work is being done to promote the use of this metal in other fields such as the chemical processing industries, where it will be useful because of its great resistance to corrosion, its unusual strength, and its light weight.

Bristol Brass Forms West Coast Subsidiary

The Bristol Brass Corp., Bristol, Conn., has formed a wholly-owned subsidiary company, The Bristol Brass Corp. of California, which will be located at 1217 E. Sixth St., Los Angeles. **John H. Smith** was named vice-president and general manager.

Wire Products Executive Named

Maxwell M. Wachowiak was recently made assistant to the president of **The Wall Wire Products Co.,** Plymouth, Mich.

JLE

SERVING THE WIRE INDUSTRY THROUGHOUT THE WORLD

- Caterpillar Pull-outs
- Standard Sets of Spark-Testing Equipment
- Take-ups and Re-spoolers
- Reelers
- Coilers
- Spoolers
- Collapsible Coiling Reels
- Wire Sparkers and Accessories
- Hand Locators
- Electrode Units and Stands
- Measuring Machines, Counters and Accessories
- Wire Guide Units
- Pay-off Reels Stands
- Electronic Devices
- Shaftless Take-ups and Payoffs
- Wire Pre-Heater
- Disk Brakes and Controls, Drag Units and Slip Clutches
- Wire Marking Machines, Type Strips, Inks
- Labelling Machines
- Pneumatic Equipment and Controls
- Special Machinery for the Wire Industry
- Hydraulic Equipment and Controls
- Hi-Pot Test Sets
- Cable Handling Equipment for Warehouse Use

See Page 1018 for News of JLE Heavy Duty, Automatic Re-reeling, spark-testing and Measuring Equipment

JAMES L. ENTWISTLE CO.

1475 ELMWOOD AVE. PROVIDENCE 7, RHODE ISLAND, U. S. A.

European & South American Agents: M. CASTELLVI, INC. 150 BROADWAY, NEW YORK 38, NEW YORK

British Associate: GENERAL ENGINEERING CO., LTD. BURY ROAD, RADCLIFFE, LANCASTER, ENGLAND

JLE - JLE - JLE - JLE - JLE

Heil Appoints Chicago Representative

Heil Process Equipment Corp. manufacturers of chemical proof tanks, tank linings, impervious graphite heat exchange equipment, lead anodes, steam jet agitators and RIGIDON plastic exhaust hoods and duct work, has recently appointed **Ken W. Grader** as Chicago District Representative. Mr. Grader will make his headquarters at 400 W. Madison Avenue, and will be able to offer immediate assistance to the many Heil customers in the Steel Industry, Chemical Industry and Electroplating Industry in this area.

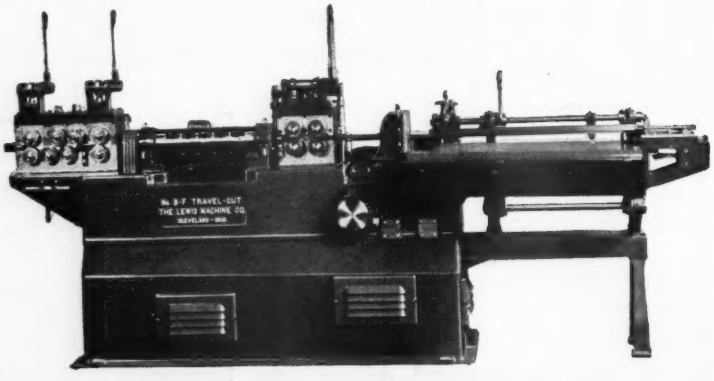
★ ★ ★

Mr. Grader received his chemical engineering degree from Case Institute of Technology and has had sixteen years' experience in the sale and service of chemical-proof process equipment. During the past three years he has been Sales Engineer in the eastern home territory of Heil Process Equipment Corp.

Fast, Accurate, Economical

STRAIGHTENING and CUTTING

with LEWIS TRAVEL-CUT



22 Models to handle from .012" to ¾" Round, Hex, Flat, Shapes.

Simple in design, rigid in construction, Lewis TRAVEL-CUT will deliver continuous dependable service under the most severe, high production conditions—day in, day out. Feeds wire from the coil, straightens accurately, gauges to uniform length, and cuts clean without stopping the wire. For steel, brass, aluminum and alloy wire. Cut your cutting costs with the Lewis TRAVEL CUT. Full details on request.

Exclusive Representatives

EAST: Penn Machinery Co., 117 North Third Street, Philadelphia 6, Penn.

MIDDLE WEST: Steel & Wire Machinery Co., 15457 Euclid Ave., Cleveland 12, O.

CENTRAL: Moslo Machinery Co., 2443 Prospect Avenue, Cleveland 15, Ohio.

WEST COAST: Hoffman & Heartt, 3005 So. Grand Ave., Los Angeles 7, California.

CANADIAN: Empire Engineering Co., 738 Dundas St., East, Toronto, Ont., Canada

CONTINENTAL EUROPE: Gaston E. Marbaix Ltd., Devonshire House Vicarage Crescent, London S. W. 11, England.

The LEWIS MACHINE Company

3441 E. 76th Street, Cleveland 27, Ohio

Also agents in Paris, Stockholm, Rotterdam, Brussels, Zurich, Milan, Bombay and Melbourne

Holden Elects Board and Officers —Buys California Plant

The A. F. Holden Company, Metallurgical Engineers, whose Eastern Division is located at 460 Grand Avenue, New Haven 8, Connecticut, has announced the election of the Board of Directors and officers for the ensuing year and the purchase of a heat treating subsidiary in California.

★ ★ ★

At the annual meeting of the stockholders in August, the following Board of Directors was elected: **Artemas F. Holden,** President and Treasurer; **John B. Carey,** Vice President; **Calvin R. Brown,** Vice President; **John R. Thim,** Secretary; **Arthur Scrivenor, Jr.; Edwin S. Snyder; Arthur W. Hansen; F. A. Hyatt;** and **F. Earle Steel.**

★ ★ ★

The newly elected members to the Board of Directors are Mr. Brown who is Vice President of the company in charge of all Eastern operations with headquarters at the New Haven plant and Mr. Steel who is Vice President of the Ferndale National Bank.

★ ★ ★

At the subsequent meeting of the Board of Directors, officers were elected as indicated by the titles following their names.

★ ★ ★

The A. F. Holden Company manufactures salt baths and pot furnaces for the heat treatment of metals, both ferrous and non-ferrous. Founded in New Haven in 1933, it now has plants in New Haven, Connecticut, Detroit and Milford, Michigan and on May 1st, this year, Plant No. 4 was opened in Los Angeles, California. The company has representatives throughout the United States and Canada as well as in twenty-five foreign countries.

★ ★ ★

In addition, the Holden Company has recently acquired a wholly owned subsidiary, Cook Heat Treating, Inc., located at 5934 Alcoa Street, Los Angeles, California; the operating executives are **Harry G. Howell,** President and **Gus Zellmer,** Vice President and General Manager.

Moves Chicago Office to New Warehouse

Firth-Sterling, Inc. has announced that its Chicago Office, formerly located at 710 West Lake Street, has been moved to its new warehouse at 3415 North Avenue, Melrose Park, Ill.

★ ★ ★

The new telephone number is FIlmore 4-5510, but for the convenience of Chicago area customers a direct Chicago line has been added. This is COlumbus 1-3773. Their teletype number is Melrose Park 1027.

★ ★ ★

R. O. Valoon is District Sales Manager in charge of this office. He is assisted by a staff of nine salesmen and two service engineers.

A. S. & W. Sales Changes

A re-alignment of responsibilities affecting three members of the sales organization of the American Steel and Wire Division of U. S. Steel Corporation was announced today by **John Graham,** general sales manager.

★ ★ ★

The Spring Products Sales Division of American Steel and Wire will be combined with the **Manufacturers Products Sales Division** and will be headed up by **Charles W. Meyers. Edmond J. Walsh** will be assistant manager of the division in charge of rods, wire, and cold rolled strip. **Robert D. Knight** will be assistant manager in charge of springs.

Spring Concern Appoints New Chief Engineer

Reliable Spring & Wire Forms Co., Cleveland, has appointed **John B. Malloy** chief engineer. During the last 24 years he has been associated with Republic Steel Corp., Wheeling Steel Corp. and Cuyahoga Spring Co.

Made Chief Engineer of Spring Company

John B. Malloy has been appointed chief engineer of **The Reliable Spring & Wire Forms Co.,** 3167 Fulton Rd., Cleveland 9, Ohio.

Firth Sterling Promotion

Firth Sterling Inc. has announced the promotion of **Raymond J. Zale** to Assistant to the Sales manager, Steel Division. He will assume the responsibilities for the sale and promotion of tool steel products. Until his recent appointment, Mr. Zale was a steel metallurgist at Firth Sterling.

★ ★ ★

Before joining Firth Sterling, Mr. Zale was employed by Lindberg Steel Treating Co., where he was Plant Metallurgist and Assistant Plant Manager of their Rochester Division. He is a graduate of Michigan College of Mining and Technology from which he received a B.S. degree in Metallurgical Engineering.

NRM

"ALL-IN-ONE"...
WIRE COVERING UNIT

Includes:

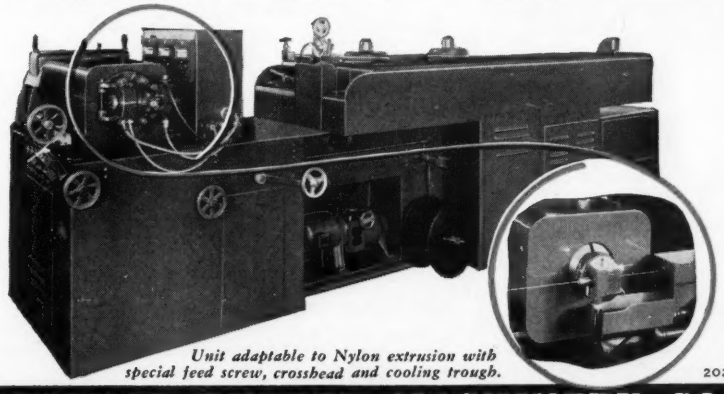
NRM's 1½" Package Wire and Cable Covering Unit packs the maximum of production into the minimum of floor space. Measuring only 13'x4'2" on its single base, this compact unit carries all the equipment needed to cover wire up to ¼" covered diameter at speeds up to 1000 feet per minute.

All wire covering plastics can be handled on this precision-built equipment — including Nylon, with a few simple changes. The automatic driven let-off is controlled by wire tension. The electrically heated 1½" extruder is equipped with Balanced Heat Control. The haul-off capstans are variable speed driven. The torque controlled dual take-up has 16" standard reels. Ample space is provided for a spark tester.

This unit is also available with an oil heated extruder.

Write, right now, for detailed information!

- Driven Supply Reel
- Wire Straightener
- NRM 1½" Extruder
- Variable Speed Drive
- Electric Die Heater
- Water Cooling System
- Dual Haul-off Capstans
- Dual 16" Take-up
- Adjustable Traverse
- Single Base Mounting



Unit adaptable to Nylon extrusion with special feed screw, crosshead and cooling trough.

2022

NATIONAL RUBBER MACHINERY CO.

General Offices & Engineering Laboratories: Akron 8, O.
East: 384 Getty Ave., Clifton, N. J.
West: S. M. Kipp, Box 441, Pasadena 18, Calif.
Export: Omni Products, 460 4th Ave., New York 16, N. Y.

Creative Engineering

Sheet and Tube Appoints Yeckley to New Post

William H. Yeckley has been appointed to a new position of general manager of steel operations for **The Youngstown Sheet and Tube Company.**

★ ★ ★

His appointment, effective Aug. 24, was announced by **A. S. Glossbrenner,** vice president in charge of operations for the company.

★ ★ ★

For the last three years Mr. Yeckley has been assistant to Glossbrenner with the title of assistant to the vice president in charge of operations. He has been directing steel operations in both the Youngstown and Chicago districts.

To Manage Merchant Products Sales for Northwestern

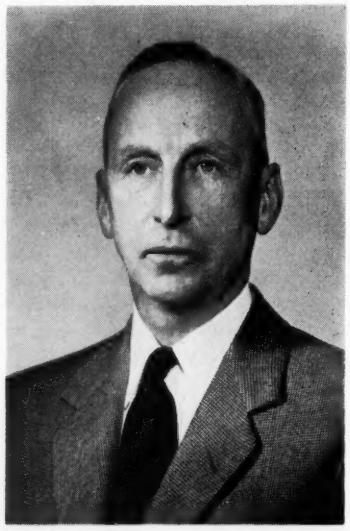
Announcement has been made of the appointment, effective May 23rd, of **Robert J. Kay** to the position of Sales Manager, Merchant Trade Products for the **Northwestern Steel & Wire Company,** Sterling, Illinois.

Orin S. Haskell Joins Rockwell

Orin S. Haskell has been added to the staff of the **W. S. Rockwell Company,** 196 Eliot St., Fairfield, Conn., as General Manager of the Electric Furnace Division.

★ ★ ★

Mr. Haskell brings to Rockwell a long and unique record in the field of electric heating equipment. For 24 years he was connected with the General Electric Company, for the last several years as manager of sales of industrial furnaces and ovens. He directed the development and expansion of G.E.'s work on wire enameling equipment. For the past year, he was associated with the engineering department of the Knolls Atomic Power Laboratory.



Orin S. Haskell

★ ★ ★

Mr. Haskell is a graduate of the United States Naval Academy and was in the Navy before joining General Electric.

★ ★ ★

As an acknowledged authority on furnaces and handling equipment for wire enameling, Mr. Haskell will devote his attention primarily to the promotion of Rockwell wire enameling equipment, but will also supervise the sale of industrial electric furnaces of all types.

"KNOW PARKIN" is right!

When you Know Parkin you'll know the finest Pickling Compounds available anywhere!

NEP — SUM-FOAM — NEPTUNE
(Inhibitor) (Foamer) (Accelerator)

Parkin products are available in powdered and liquid form. Phone or write for a shipment today and begin getting better pickling at less cost right away.

You can save a lot of acid and a lot of metal by *controlling* your pickling operations with Parkin products.

Using Parkin products in the bath, you will cut down acid carry-over and dragout. You'll put an end to overpickling. You'll get faster, safer, cleaner pickling.

Your men will appreciate the change, too, because Parkin products act as a powerful deterrent to acid spray and fumes.

parkin CHEMICAL COMPANY
Highland Bldg. • MOntrose 1-0176
PITTSBURGH 6, PENNA.

PICKLING SPECIALISTS
Parkin of Pittsburgh
IN STEEL SINCE 1860

Reel Manufacturer Expands Facilities

Carris Reels, Inc., Rutland, Vermont, has completed a modernization and expansion program that has resulted in the tripling of its present facilities.

★ ★ ★

The company manufactures returnable and non-returnable plywood reels and spools embodying design features that give them exceptional strength and ruggedness in spooling and shipping operations. The expansion was occasioned by a growing demand for their reels.

Bristol Names Manager of Application Engineering

Announcement of the appointment of **D. C. Sanford** to the position of manager of the Application Engineering Department of **The Bristol Company,** Waterbury, Conn., has been announced by **Harry E. Beane,** Vice President-Sales.

★ ★ ★

Mr. Sanford joined the company's sales engineering organization in 1937 and was promoted to Birmingham district manager in 1946. In 1948 he became an application engineer with headquarters at the company's main office in Waterbury, Conn.

British Engineer Joins Torrington

The Torrington Manufacturing Company has announced the appointment of **Ronald Page** of Colchester, England, as Night Factory Manager of the firm's Torrington, Conn. plant, world's largest maker of air impellers and spring coiling machines.

★ ★ ★

Since 1938, Mr. Page has been Works Manager of Woods of Colchester, manufacturer of electric motors and fans for home and industrial use. He received his engineering degree from University College, Nottingham, and became section leader of the Raleigh Cycle Company's jig and tool design office by the time he was 20 years old.

★ ★ ★

He subsequently specialized in machine tool design while working with the Ransome and Marles Ball and Roller Bearing Company and later joined BSA Tools, Limited, where he was in charge of tooling layouts and machine modifications for special work.

Cavert Wire Appoints Agent

Cavert Wire Co., Uniontown, Pa., manufacturer of baling wire and bale ties, has appointed **M. & A. Steel Sales & Service, Inc.** as its West Coast representative.

American Wheelabrator Makes Personnel Advancements, Additions

American Wheelabrator & Equipment Corp., Mishawaka, Indiana, manufacturers of blast cleaning machine and dust and fume control equipment, has made promotions in and additions to both its home office and field sales personnel.

★ ★ ★

In the company's home office,

"KNOW PARKIN" is right!

When you Know Parkin you'll know the finest Pickling Compounds available anywhere!

NEP — SUM-FOAM — NEPTUNE
(Inhibitor) (Foamer) (Accelerator)

Parkin products are available in powdered and liquid form. Phone or write for a shipment today and begin getting better pickling at less cost right away.

You can save a lot of acid and a lot of metal by *controlling* your pickling operations with Parkin products.

Using Parkin products in the bath, you will cut down acid carry-over and dragout. You'll put an end to overpickling. You'll get faster, safer, cleaner pickling.

Your men will appreciate the change, too, because Parkin products act as a powerful deterrent to acid spray and fumes.

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PICKLING SPECIALISTS
Parkin of Pittsburgh
IN STEEL SINCE 1860

Robert L. Orth was appointed Field Sales Manager, after 14 years' service as District Manager in the Detroit sales office. **Julius E. Skene** was advanced to Manager of Customer Service, and **Philip R. Jordan** was promoted to Chief Sales Engineer.

★ ★ ★

Gordon R. Bryant was promoted to District Manager of the Detroit office. **John W. Swantz,** formerly of the firm's Chicago office, joined the Detroit office as a District Sales Engineer, and **Erwin C. Shepard** was added as a Service Engineer.

★ ★ ★

F. H. Toman was appointed District Sales Engineer to replace Mr. Swantz in the Chicago office. He was formerly District Service Engineer in the Toronto, Ontario, office. **J. Douglas Lamb** was appointed District Service Engineer for the Toronto office.

★ ★ ★

Also announced was the appointment of **Wilfred G. Carrie** as District Manager of the Seattle office. He was formerly a home office project engineer in the company's Dust & Fume Control Division. **George C. Tolton,** former Seattle District Manager, has been appointed District Manager of the Greensboro, North Carolina, branch.

Elected Vice President and General Manager of Canadian Operations of International Nickel

J. Roy Gordon has been elected Vice President and General Manager of Canadian Operations of The International Nickel Company of Canada, Limited, succeeding the late **R. Leslie Beattie** in both capacities, **Dr. John F. Thompson,** Chairman of the Board of Directors of Inco, has announced.

★ ★ ★

Mr. Gordon has been an Assistant Vice President since December, 1947, and in addition was appointed in May, 1952, Assistant General Manager of the Company's Canadian Operations under Mr. Beattie.

★ ★ ★

He joined Inco in 1936 when he was appointed Director of the Research Department established in that year at Copper Cliff, Ontario, by The International Nickel Company of Canada, Limited. Mr. Gordon was made an Assistant to the Vice President in 1941 and Technical Assistant to the Vice President in 1946.

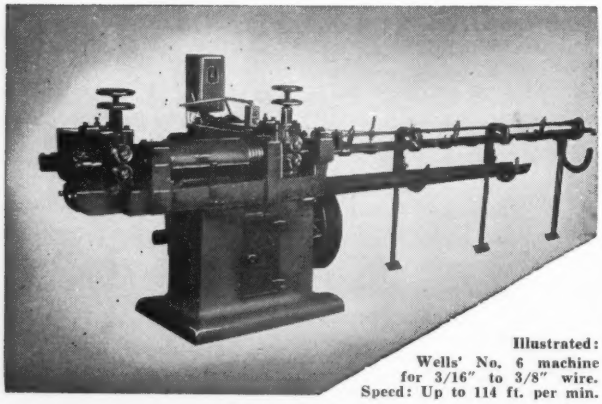
Bakelite Promotes Sales Executives

C. W. Blount has been appointed Vice President in Charge of Sales and **H. K. Intemann** has been named Vice President and General Sales Manager for Bakelite Company, a Division of Union Carbide and Carbon Corporation, it was announced recently by **George C. Miller,** President. Mr. Blount succeeds Mr. Miller who was named president of the company early in June. Mr. Intemann succeeds Mr. Blount. A graduate of the United States Naval Academy, Mr. Blount joined Bakelite Company in 1924. Mr. Intemann joined the company in 1930 following his graduation from Stevens Institute of Technology.

What do you want in your

STRAIGHTENER and CUTTER?

- **DEPENDABILITY?** **WELLS machines provide day-in, day-out continuous operating service.**
- **SPEED?** **These automatic rotary machines will not only give you speed, but accuracy as well.**



Illustrated: Wells' No. 6 machine for 3/16" to 3/8" wire. Speed: Up to 114 ft. per min.

Cuts wire in any length from 7½" up to 25'. Special attachment furnished on order for long lengths. Straightener flier runs in ball bearings. Gear drive and motor enclosed in base. Door provides accessibility.

58 years of experience and continuous engineering, with use of finest materials, have put WELLS machines in a class by themselves for excellence of performance. Built to handle the toughest jobs, year after year, with little or no servicing. Supplied in a complete range of sizes.

Send for Catalog covering the full line.

Frank L. Wells Company

KENOSHA • 5821 Fifth Avenue • WISCONSIN

Builders of Fine Wire Working Machinery

Coast Wire Products Concern Moves to New Quarters

Powers Wire Products Company, manufacturers of Power-Line Staplers, have just moved to a new plant built and designed especially for their needs, in Monterey Park, suburb of Los Angeles. The new plant doubles the production capacity of the firm.

★ ★ ★

The company manufactures a complete line of hand and air-operated staplers, staples in all sizes for these machine and hog rings for industry.

★ ★ ★

Started in 1945 by **R. E. Powers** and **M. E. Powers,** the company has shown a steady substantial growth reflecting the quality of its products and the growing demand for staplers in all types of industry. Power-Line Staplers have demonstrated their efficiency in doing a better, faster job than nailing, gluing and other similar operations.

★ ★ ★

Eastern orders are supplied from Powers Plant No. 2 at Monroe, Michigan, opened in 1950, to service the area east of the Mississippi. Sales are handled through distributors and direct factory representatives in key centers throughout the United States.

Organizes Steel Supply Company

Norman J. Froelich who has been associated with the steel industry for the past thirty years has now organized the **Froelich Steel Supply Company,** with offices located in the Grant Building, Pittsburgh 19, Pennsylvania.

★ ★ ★

This new company will deal in in all phases of steel, including warehouse facilities, and at present will handle primarily sheet and strip, expanding into other fields as prove expedient.

★ ★ ★

Mr. Froelich has served in executive sales capacities for the past several years with the Pittsburgh Steel Company, Detroit Steel Corporation, Portsmouth Steel Corporation, and Reynolds Wire Company. In addition he served as an administrator of steel orders in the War Production Board during World War II.

★ ★ ★

As a result of this past experience, Mr. Froelich brings into this new company a broad knowledge of the steel industry.

Becomes Townsend's Purchasing Agent

Townsend Co., New Brighton, Pa., has appointed **Robert W. Daumiller** purchasing agent. He succeeds **W. W. Rinehart** who retires after serving in that position for the last 16 years. Mr. Daumiller joined Townsend in 1946 and last year was made assistant purchasing agent.

Convert Process Fumes to

USEFUL HEAT

Eliminate visible smoke, offensive odors, duct condensate — with its fire hazard and cleaning problems — by CATALYTIC FUME COMBUSTION of exhaust gases from:

- **WIRE ENAMELING**
- **VARNISH COOKING**
- **PAINT BAKING**

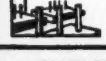
and similar solvent or other hydrocarbon liberating processes.

There may be possibilities of profitable recovery of heat energy.

Hundreds of successful installations.

Representatives in principal industrial areas—domestic and foreign.

Patents pending



Catalytic *Fume Incineration for Industry*

COMBUSTION CORPORATION

4540 GRAND RIVER AVENUE DETROIT 8, MICHIGAN

Opens Warehouse in Louisiana

A new district sales office and warehouse has been opened in New Orleans, Louisiana, by the Wickwire Spencer Steel Division of CF&I. **Ford L. Brooke,** who formerly handled sales of wire rope for CF&I in Louisiana, has been appointed New Orleans District Manager.

★ ★ ★

Establishment of this new district office in New Orleans marks the company's response to the expanding market for their products in the South. CF&I's new office in New Orleans will serve not only the immediate area surrounding the city, but a territory comprised of Mississippi, Louisiana, Tennessee and Arkansas.

★ ★ ★

Located at 7930 Palm Street, New Orleans, the new sales center and warehouse will stock supplies of "Realock" chain link fence, screen cloth, hardware cloth, flanged and dished heads, and general purpose fabric and netting. Wire rope will not be warehoused here, since the corporation does not contemplate any changes in the present distribution of this product in this part of the United States. However, the sales office will act as a sales outlet for all of the corporation's products.

Thermoplastic
Cable Sheathing Kraft

the patented paper used in

NONMETALLIC SHEATHED CABLE

Is highly water repellent.
Available in all weights
both creped and flat.

Merrimac
Paper Co., Inc.

Mills — Lawrence, Mass.
295 Madison Ave., New York City

Also manufacturers of many tailor-made
Varnishing, Saturating, Tubewinding
and Insulating Papers

Wire Concern Moves to Uniontown, Pa.

The Cavert Wire Company, formerly of Ellwood City, Pa., is now established in new quarters on Gallatin Ave., Extension, Uniontown, Pa. **Wolford Swimmer,** General Manager of the firm, said the move was made to give customers better service through better truck and rail facilities available in Uniontown. An addition to the building the plant now occupies will further facilitate more economical production.

★ ★ ★

Meyer Swimmer, President, has operated a wire hanger factory in Uniontown for several years. The Cavert firm specializes in manufacturing all types of strand annealed quality steel wire, bale ties, spooled wire for automatic balers and bundling wire for farm and industry.

★ ★ ★

Owners of the Cavert firm revealed also that considerable new machinery is being installed at the new plant to give customers an even higher quality product. The Cavert firm operated in Ellwood City for nearly half a century and is the largest manufacturer devoted exclusively to the production of baling wire.

Moves Chicago Office to New Warehouse

Firth-Sterling Inc., has announced that its Chicago Office, formerly located at 710 West Lake Street, has been moved to its new Warehouse at 3415 North Avenue Melrose Park, Ill. The new telephone number is FIlmore 4-5510, but for the convenience of Chicago area customers a direct Chicago line has been added. This is COlumbus 1-3773. Their teletype number is Melrose Park 1027.

★ ★ ★

R. O. Valoon is District Sales Manager in Chicago of this office. He is assisted by a Staff of wire salesmen and two service Engineers.

To Develop New Products for Naugatuck Chemical

Albert M. Stover, formerly manager of Marvinol plastics development, has been appointed assistant to the director of research and development of the **Naugatuck Chemical Division, United States Rubber Company,** it was announced recently by Earle S. Ebers, director of research and development. He will work principally on the development of new products.

★ ★ ★

A graduate of Yale, Mr. Stover has been with Naugatuck Chemical since 1949 when the chemical division of the Glenn L. Martin Company was purchased by Naugatuck Chemical. At Glenn L. Martin, Mr. Stover had been director of development for the chemical division.

Reynolds Metals Names New Detroit Distributor

Appointment of **Meier Brass & Copper Company,** 2971 Bellevue Avenue, Detroit, Michigan as a distributor of Reynolds Aluminum has been announced by **Reynolds Metals Company** through its General Sales Office in Louisville, Kentucky. Meier will stock aluminum wire, rod, and bar in standard alloys and tempers. The firm also will handle Reynolds Aluminum cast plate and bar for tools, dies and fixtures in a wide range of sizes.

★ ★ ★

Meier Brass & Copper is completely equipped to provide prompt service on these items. The new appointment will increase the availability of these aluminum products in the Detroit area.

To Head Research for Universal-Cyclops

Universal-Cyclops Steel Corp., Bridgeville, Pa., has appointed **James D. Nisbet** director of research and development. He has been manager of materials and process section at General Electric Co.'s research laboratory.

Fred C. Young

Fred C. Young, manager of sales for the **Union Drawn Steel Division** of **Republic Steel Corporation,** died at Massillon, Ohio, August 14th after a short illness.

★ ★ ★

Mr. Young, 60, was a native of Detroit. He joined Union Drawn in 1916 and became manager of sales in 1930. He had made his headquarters at Union Drawn's offices in Massillon since 1932.

★ ★ ★

William F. Boore

William F. Boore, 67, Sales Coordinator of the **Nichols Wire & Aluminum Company,** Davenport, Iowa, died suddenly on August 11th.

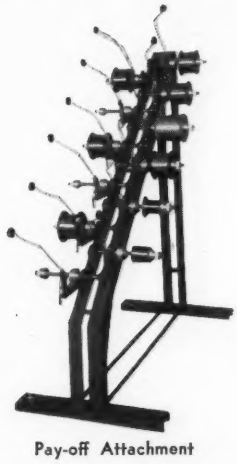
★ ★ ★

Mr. Boore had been associated with the Nichols Company since 1950. Prior to that time he was Assistant Sales Manager of the Pittsburgh Steel Company, with whom he had been affiliated since 1906.

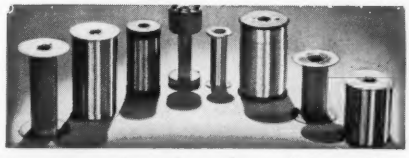
STANDARD UNI-DRIVE WIRE WINDER.

INCREASE YOUR PRODUCTION WITH THIS WINDER

Wire Winder



Pay-off Attachment



Various types of supply packages that may be wound on Standard Uni-Drive Wire Winder.

PAYOFF

Our payoff attachment is made with self-aligning ball bearings and a compensating attachment to control the tension of each end. Applies same tension when spool is empty as when full.

The new Uni-Drive Winder with Payoff Attachment is new in design and incorporates several improved and tested features. Production is stepped up through increased speed. It produces smooth, even and accurately wound spools of wire in single or multiple ends. All strands parallel—no over or under-winding. Automatic Stop-Motion controls each strand. Compensating attachment produces perfectly controlled tension. Traverse adjustable from 1¾" to 5½" between spool heads without changing cam. Designed especially for winding wire to be braided and shielded for electrical conductors up to ¾" diameter.
Payoff can be equipped with Carboloy Guide Inserts at additional cost.

STANDARD MILL SUPPLY COMPANY
PAWTUCKET, RHODE ISLAND, U.S.A.
1064-1080 Main St.
PAwtucket 3-1534 — 3-1535 — 3-1536

A Review of Recent Wire Patents

No. 2,647,696, STATOR WINDING MACHINE, patented August 4, 1953, by Andre Brunand, Lyon, France, assignor to Societe Anonyme styled: Compagnie Electro-Mecanique, Paris, France.

A machine is provided for winding simultaneously several phase-windings of multiphase multipolas alternating current stators provided with notches and designed for having several winding planes.

★ ★ ★

No. 2,647,702, WIRE REEL MOUNTING, patented August 4, 1953, by John G. Wright, Charles D. Toney, Charles A. Watkins, and Eugene Sudan, Atlanta, and William A. Maxwell, Duluth, Ga., assignors to The Auto-Soler Company, a corporation of Georgia.

The reel, with its flanges, may be removed as a unit or one of the flanges removed to allow replacement of an exhausted wire supply on the reel.

★ ★ ★

No. 2,648,223, METHOD OF TESTING THE WINDING PROPERTIES OF FILAMENTS, patented August 11, 1953, by Melvin Fielding, Chicago, and Otto S. Mundy, Wheaton, Ill., assignors to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

A method of determining the surface lubrication characteristics of wire is disclosed which includes winding a length of wire around a rotating mandrel while maintaining a predetermined tension thereon, maintaining the guide point at which the wire is directed to the mandrel fixed, and measuring the axial distance of the convolutions of wire formed between the intersection of a line through the guide point normal to the axis of the mandrel and the point at which the convolutions start to double back to start a second layer.

★ ★ ★

No. 2,648,356, DEVICE FOR WINDING WIRE ABOUT TERMINALS, patented August 11, 1953, by Ezra J. Beaulieu, Downers Grove, Leif E. Haagensen, Barrington, and Oscar Scharer, Chicago, Ill., assignors to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

This is a hand-held device. There are 13 claims.

★ ★ ★

No. 2,648,460, ATTACHMENT FOR PAINT CANS, patented August 11, 1953, by John W. Tatter, Akron, Ohio.

The attachment comprises a continuous length of galvanized half hard steel wire, and provides a scraper for a paint can.

★ ★ ★

No. 2,648,502, POWER WINDING OF STRIP MATERIAL, patented August 11, 1953, by Lev A. Trofimov, Willoughby, Ohio.

It is the primary object of the invention to provide a universally adjusted winding control and one which, alternatively, can be constructed originally to respond without adjustment, to develop a predetermined tension in the material as winding goes on.

★ ★ ★

No. 2,648,503. TAKE-UP BLOCK FOR WIRE DRAWING, patented August 11, 1953, by Daniel Revak, Donora, and Frederick W. Riedel, Belle Vernon, Pa., assignors to United States Steel Corporation, a corporation of New Jersey.

This is described as an improvement upon the block disclosed in U. S. Patent 2,529,185. The invention contemplates a collapsible core or barrel.

★ ★ ★

No. 2,648,513, NURSING BOTTLE HOLDER, patented August 11, 1953, by Ellsworth E. Groff, Hayden, Ariz.

This device is constructed of several lengths of wire, bent to shape.

★ ★ ★

No. 2,648,531, WIRE ENAMELING OVEN, patented August 11, 1953, by Leonard J. Shorek and William L. Best, Detroit, Mich., assignors to Young Brothers Company, Detroit, Mich., a corporation of Michigan.

The primary object of the invention is to provide means for rapidly cooling the work space of an oven without affecting the temperature of the rest of the oven.

★ ★ ★

No. 2,648,625, METHOD OF ELECTROCOATING STRIP, patented August

USERS OF THESE CABLE REEL BORERS REPORT

PRODUCTION INCREASES UP TO 500%

In one single operation, this remarkable machine bores ALL the holes in a wooden cable reel head. In addition, it has the exclusive Root Patented Hydraulic Feed which provides a stepless range of feed from 2 to 29 strokes per minute. Operator is not handicapped by limited feed rate. This increases production tremendously. Can also be used for other boring purposes. Made in three sizes. *Write for Bulletin No. 132.*

"Can honestly say this machine alone has increased our production over 200%! Our profits increased 100%!"

V. Fairhurst, Mgr. New England Reel and Lumber Co.

ROOT

HYDRAULIC FEED REEL BORER

Root Reel Borer being used by New England Reel & Lumber Co.

B. M. ROOT CO **YORK, PA.**

11, 1953, by Joseph S. Buser, deceased, late of Maryland Heights, W. Va., by Doris E. Morgan (formerly Doris E. Buser), administratrix, Altoona, Pa., assignor to National Steel Corporation, a corporation of Delaware.

There are nine claims to a method of continuously and progressively manufacturing electro-tinplated strip material. The method includes rinsing the strip with an aqueous rinse solution obtained by admixing water and a tin-free acidic fluorine compound, the amount of tin-free acidic fluorine compound in the rinse solution being sufficient to reduce the pH value of the acqueous rinse solution to the point where hydrolysis of the tin salt carried from the plating bath on the strip is substantially prevented, thereby removing tin salt from the strip.

★ ★ ★

No. 2,648,626, METHOD OF ELECTROLYTIC COATING, patented August 11, 1953, by Joseph S. Buser, deceased, late of Maryland Heights, W. Va., by Doris E. Morgan (formerly Doris E. Buser), administratrix, Altoona, Pa., assignor to National Steel Corporation, a corporation of Delaware.

Here the method includes continuously and progressively manufacturing electro-tinplated strip.

★ ★ ★

No. 2,648,842, MECHANISM FOR MAKING WIRE REINFORCED FABRIC SPRING LINERS OR THE LIKE, patented August 18, 1953, by Newton E. Shockey, Detroit, and Howard Wendall Wilkins, Centerline, Mich., assignors to Van Dresser Specialty Corporation, Van Dyke, Mich., a corporation of Michigan.

A mechanism is provided for making wire reinforced fabric spring liners having devices for advancing a fabric web in successive steps separated by pauses and having mechanism operating in timed relationship with the devices for feeding wire transversely through the web during the pause following each step, the last mechanism operating in timed relationship with means for cutting off the wire thrust through the fabric and bending an end thereof over a part of the fabric web to hold the web in an extended position along the wire.

★ ★ ★

No. 2,649,130, COIL SPRING WINDER, patented August 18, 1953, by Lester A. Border, Pendleton, Oreg.

It is stated that the winder can wind springs of any desired length, diameter and pitch and under any desired winding tension.

★ ★ ★

No. 2,649,208, PAPER FORM HOLDER, patented August 18, 1953, by Glenn C. Wilson, Oak Park, Ill.

This holder is constructed of a continuous length of wire formed to provide a number of short and long wire fingers, some being arranged in different planes.

★ ★ ★

No. 2,649,830, EXPANDING SPRING ANCHOR NUT, patented August 25, 1953, by John William Arnold, Newark, N. J., assignor to The Elwood Research Company, a division of Chiselhurst, Inc., Newark, N. J., a corporation of New Jersey.

An expansion fastener is disclosed for cooperation with screws and bolts and comprises a heterophase wire coil with at least two integral helical winding phases spaced axially of each other and having anchoring ends.

★ ★ ★

No. 2,649,899, PADDING SUPPORT, patented August 25, 1953, by Harold E. Williams, Carthage, Mo., assignor to Frank B. Williams and Harold E. Williams, both of Carthage, Mo.

A padding support is described in this patent comprising a pair of spaced-apart, parallel cord-like side members and a series of parallel, spaced-apart flexible wire members; each having eyes at its opposite ends to respectively clampingly engage the side members.

★ ★ ★

No. 2,650,345, APPARATUS FOR LOCATING CABLE FAULTS, patented August 25, 1953, by John P. Lozes, Jr., New Orleans, La.

Means for locating faults in a cable by the pulse-reflection method is disclosed. There are six claims.

★ ★ ★

Bulletin Gives Specifications on Hydraulic Riveting Equipment

The Manco Manufacturing Company recently issued a new bulletin giving complete information on their standard hydraulic riveting heads, yokes, and rivet sets. Also included is information and specifications on pump units, valves, and suspension balancers. A copy may be obtained by writing to: Manco Manufacturing Company, Bradley, Illinois.

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TUNGSTEN CARBIDE

METALS
DIES
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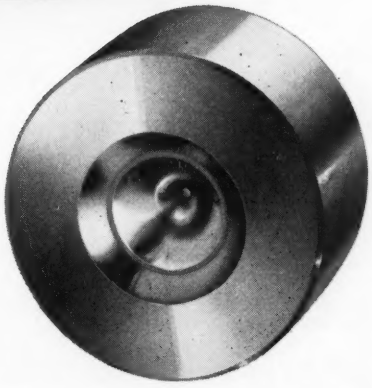
for the Wire Industry



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Electrical Safety Program Announced

Commissioner Dominick F. Paduano, of the New York Department of Water Supply, Gas and Electricity, today endorsed a "Safety Through Adequate Wiring" program for the New York Metropolitan area.

★ ★ ★

The program will be launched as the theme of the Second National Electrical Industries Show, sponsored by the Eastern Electrical Wholesalers Association, for the electrical and allied trades, at the 69th Regiment Armory, 26th Street and Lexington Avenue, New York, September 29 through October 2.

★ ★ ★

More than 125 of the nation's leading electrical manufacturers will display new product developments, stressing electrical safety in residential, commercial and industrial buildings.

Increasing Spring Wire Production

Production of high carbon spring wire by The Colorado Fuel and Iron Corporation will be raised by about 12,000 tons annually through the addition of new machinery now being installed in the Buffalo, N. Y., plant of CF&I's Wickwire Spencer Steel Division, according to **A. F. Franz,** president.

★ ★ ★

Two modern continuous wire-drawing machines were added to the Wire Mill Department of the Buffalo plant, and began operations during the month of August.

★ ★ ★

These machines embody the latest engineering advances in wire-drawing equipment and will substantially increase the CF&I plant's output of hard-drawn spring wire for use in the automotive, mechanical, bedding, and furniture spring industries.

First Low Melting Silver Alloy to Flow Easily on Tungsten Carbide Announced

Newly created EutecRod 1602, which features unusual "flowing" characteristics on tungsten carbide, difficult to braze alloys and steels, etc. has been announced by Eutectic Welding Alloys Corporation.

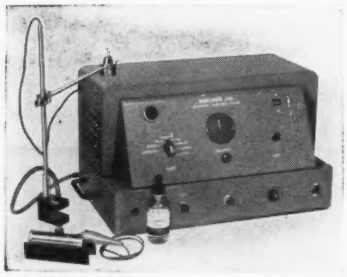
★ ★ ★

Unlike conventional alloys for this work, which cause the formation of unbound islands unless extreme care is taken during application, it is claimed the new EutecRod 1602 flows smoothly and easily even at elevated temperatures, permitting the use of silver brazing-type joints on ALL "tough-to-bond" alloys which have refractory oxides of chromium, vanadium, nickel, etc.

★ ★ ★

In addition, this new product features the outstanding advantage of considerably lower heat input required for "T" and butt joints where a "white" solder-type alloy is desired on stainless steel. This new rod is available in 3/64"-1/16"-3/32" and ⅛" diameters. For further details, prices, etc. write Dept. "P" EUTECTIC WELDING ALLOYS CORPORATION, 172nd St. and Northern Boulevard, Flushing, N. Y.

IF YOU PLATE WIRE



you can test the thickness of plating on wire . . .

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KOCOUR ELECTRONIC THICKNESS TESTER

It's no longer necessary to spend many hours of laboratory time to determine the thickness of plating on wire. The Kocour Electronic Thickness Tester can do the job quickly and accurately. Operation is simple . . . requires no graphs or standards.

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Roebling Issues Three New Bulletins

John A. Roebling's Sons Corp., Trenton 2, N. J., has issued three bulletins any one or all of which may be secured by writing the company.

★ ★ ★

"Introducing Roebling Roetemp" describes a new magnet wire insulation designed for Class B applications. The characteristics, applications and advantages are covered, together with comparative tests on "Roetemp" and other types of insulation.

★ ★ ★

"Roebling Strand and Fittings for Prestressed Concrete" is a technical treatise illustrated with photographs, drawings and property tables pertaining to their prestressed concrete strand.

★ ★ ★

"Electric and Thermal Properties of Roebling Aircord," is also a technical bulletin. It contains physical property data, design considerations, temperature change effects and a description of methods of determining stress-strain.

New Carbide Tools for Extruding Machines Have Extraordinary Life

The Wire Tool Division of Bridgeport Jig Boring Company, 303 Stratford Ave., Bridgeport, Conn., are making records in the production of plastic and rubber covered electric wires.

★ ★ ★

These tools, called nozzles or guide tips, are the tools through which the plastic is forced in its application to wire. They are made to the highest precision tolerances and are so superior to the standard tool steel nozzles previously used in extrusion machines that in the last two years customers have found that they will produce 300 times the amount of wire that the previous types used. In other words, a tool steel nozzle has a maximum life of 50,000 feet of wire, after which it must be replaced; whereas the carbide nozzle is running off 15 million feet of wire before showing signs of becoming off-size.

★ ★ ★

This remarkable result is a development of the Bridgeport Jig Boring Company, operated by M. Milewski and Joseph Coggianello, who have been engaged for some years in the production of tungsten carbide tools and parts made to extremely close tolerances to customers' specifications and who are organized to give special service to the wire industry.

★ ★ ★

Information on these nozzles will be furnished upon request to the company.

BISRA Issues Survey

The British Iron and Steel Research Association, 11 Park Lane, London, WC 1, England, has issued a "B.I.S.R.A. Survey," in which recent achievements and developments in the steel industry are outlined in a series of ten brief articles. Copies of this Survey will be sent to interested persons upon request.

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*ROBINSON DRY BLENDER
A Complete Plant to Dry-blend Poly Vinyl Chloride for Extrusion and Molding
PRODUCTION 75 lbs. to 5000 lbs. per hour
JACKETED TEMPERATURES 250° F to 350° F
More Economical! More Flexible!
RDB Plant comprises Sifter, Heated Blender, Plasticizer Tank and Cooler (individually adjusted to blending room conditions)
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JACKETED PLASTICIZER TANK
SIFTER DRIVE
BRUSH SIFTER
The Robinson Engineering Department Staff offers you Specialized Layout Service. Write for Details
DUAL JACKETED MIXER
MIXER DRIVE
DISCHARGE GATE
Schematic Typical of R. D. B. Plant
Over a Half Century of Processing Experience
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UNIQUE
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Wire Processing Equipment
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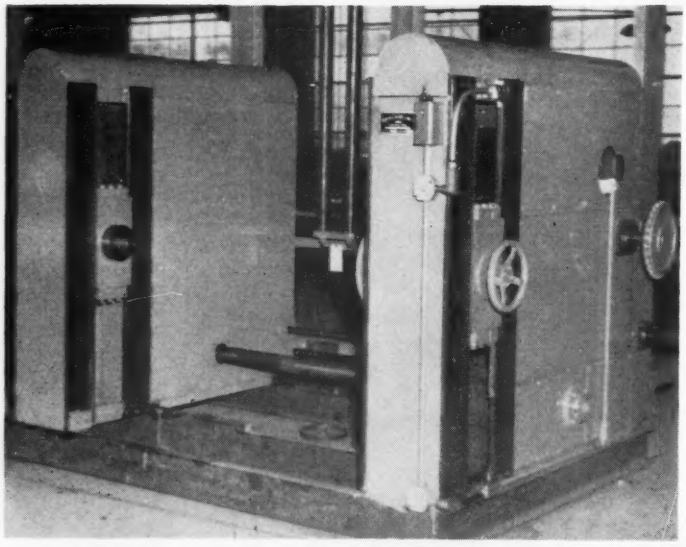
NEW— HUGHESVILLE LET-OFF STAND



- 40" TO 84" DIAMETER REEL CAPACITY
- MANUALLY ADJUSTABLE TO ANY REEL WIDTH
- 6 TO 1 VARIABLE SPEED HEAVY DUTY TRAVERSE
- MOTORIZED REEL LIFT
- ANTI-FRICTION BEARINGS THROUGHOUT
- PRIME DRIVE ADAPTABLE TO CUSTOMERS' REQUIREMENTS

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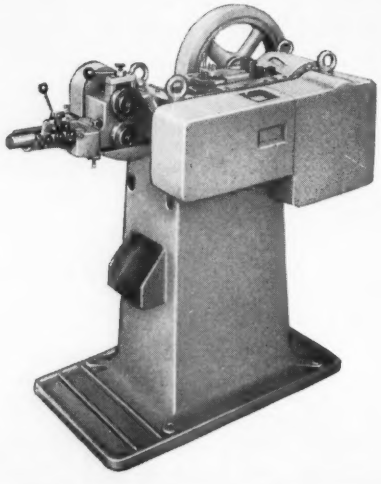
Machines for making Steel Screws:
Double Stroke Heading Presses
Head Trimming and Shank Reducing Machines
Machines for Rounding off the End
Screw-Head Slotting Machines
Thread Rolling Machines
High Efficiency High Speed Wire Nail Presses
Roofing Nail Machines
Machines for making Shoe Tacks:
Cut Tack Machines
Wire Tack Machines



Double Stroke Press Model TRPH (Minus) for the manufacture of contact points and small rivets from precious metals up to 1½ mm dia. of wire (iron 1 mm).

Machines for making Wood Screws:
Single Stroke and Double Stroke Presses
Head Turning and Slotting Machines
Thread Cutting Machines
Thread Milling Machines
Wire Forming Machines
Staple Making Machines
High Speed Barbed Wire Machines
Wire Straightening and Cutting Machines

Bulletin On New Immersion Heater

A bulletin describing a new type of immersion heater for corrosive acid solution has been issued by Glo-Quartz Electric Heater Co., 37934 Elm St., Willoughby, Ohio.

★ ★ ★

The heater is intended for all plating solutions, for pickling solutions and vapor degreasing solutions. It is said to be easy to install, to heat up quickly, to be acid resistant and immune to thermal shock. Many other desirable features are claimed, all of which are described in Bulletin TL-52, that will be sent upon request.

Technical Bulletin On Heat Treating

The A. F. Holden Company, 11300 Schaefer Highway, Detroit 27, Mich., has published a technical bulletin on austempering and martempering in which tables containing data for various steels and operating conditions are given. The bulletin contains an improving array of important information, that you may secure upon request to the company.

Stauchen und Pressen (Upsetting and Pressing)

A book by J. Billigmann, published in German by Carl Hanser Verlag, Munich, Germany, 574 pages, 5½ x 8¼. Price: 28.50 German marks.

★ ★ ★

The text is a treatise on the mass production of small and medium sized objects by plastic deformation, the forming of products from rod and wire is included. Preparation of stock, forming techniques, heat-treating testing, surface blemishes, decaburization and many other angles bearing upon all phases of production from the incoming ferrous and non-ferrous stocks to the finished objects, is covered.

★ ★ ★

A considerable amount of data is included and comparisons between German and American machines used in production are presented. The economics of production methods is treated at length and appendices contain a bibliography some 350 references and a list of patents pertaining to plastic deformation.

★ ★ ★

The author is well known in Germany for his investigations of heading processes and is said to have achieved in this book a happy balance between laboratory data and shop practices.

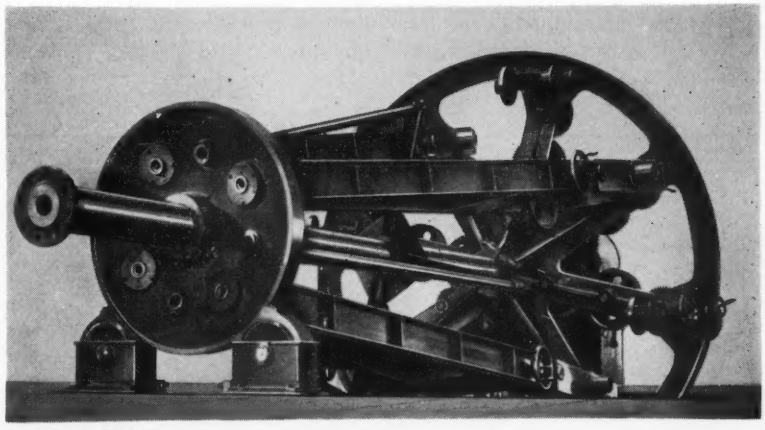
Sees Expanding Markets for Glass Fibers

According to **R. H. Barnard,** president of **Glass Fibers, Inc.,** the glass fiber industry can easily be a 300-million dollar business by 1960 and there are wide markets for every aggressive, ingenious company in the industry. Mr. Barnard made this statement in highlighting the opening session of his company's two-day general

MAILLEFER S. A.

RENENS-LAUSANNE (SWITZERLAND)

Machinery for the Wire Industry



Laying-Up Machine

For 3, 4, 6 or 8 drums up to 80" dia., fully ball-bearing mounted, with back-turn 0 or 1:1, remote electric control for the position of every cradle, fully protected driving mechanism. Special design to suit exactly the customer's requirements.

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For the U.S.A. to: **J. L. Entwistle, Providence 7, R. I.**

sales meeting held recently.

★ ★ ★

Recent developments in the cushioning, air conditioning high temperature insulation, paper reinforcing and filtering fields currently point to extensive markets for the company's lightweight wool and micro-fiber products, Mr. Barnard said.

★ ★ ★

Glass Fibers Inc. recently reported sales for the first half of this year totaled $2,762,234, up almost $1-million over sales in the corresponding period in 1952.

Furnaces by the Carload

An interesting report is made by **Lee Wilson Engineering Company, Inc.** on the operations of their new assembly plant in Elyria, Ohio.

★ ★ ★

In this plant, bell type annealing furnaces of all diameters and heights are assembled complete with all refractories installed and otherwise ready for operation as delivered to the customer's plant.

★ ★ ★

Many of these new furnaces are entirely too high to be shipped in one piece so they are built in a height suitable for rail clearance and then the top part of the furnace is shipped as a separate piece, but also completely bricked, ready to be placed on the bottom in a match-marked position and then to be bolted together and welded in place to complete the unit. The illustration below shows one of these jobs ready with the three bottom portions of three furnaces on one car and the top portion of these three furnaces on a second car, ready to be pulled out toward its destination.

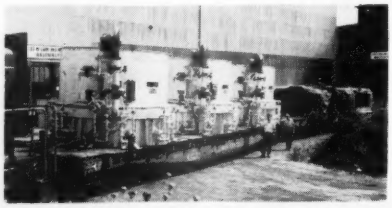


Fig. 1—Assembled furnaces leaving Assembly Plant of Lee Wilson Engineering Co., Inc., Cleveland, Ohio. Furnaces are shipped in two pieces, bottom section in first car and top section in second car.

★ ★ ★

Another illustration shows the interior of the Lee Wilson Assembly Plant with a number of jobs under construction. In this plant, besides the furnace and base operations, gas generating equipment for all types of atmosphere gases is constructed for shipment as completed units. Generators up to as high as 20,000 cfh. capacity have been built in the plant and then transferred to the ultimate destination.

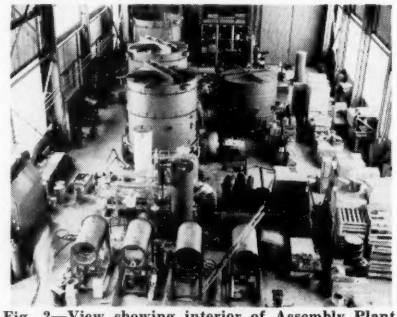
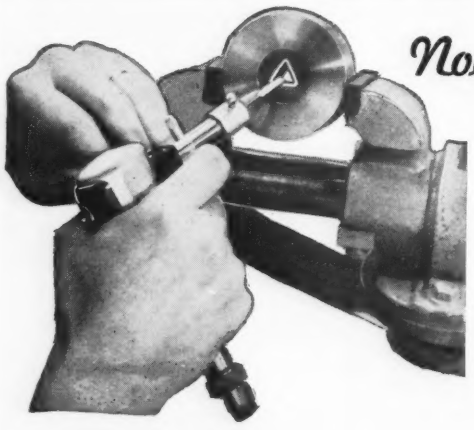


Fig. 2—View showing interior of Assembly Plant of Lee Wilson Engineering Company, Inc., with gas generating equipment in foreground and furnaces in background being prepared for shipment completely assembled.



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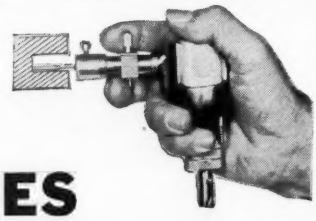
REPAIR
CARBIDE DIES
50 TIMES FASTER



Than by the old hand filing method
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This tool is light, portable and fast-cutting. Comes equipped with a set of diamond files and hones and can cut, lap and polish at unprecedented speeds—the tools are operated at 28,000 strokes per minute. Good for round dies, but especially efficient and fast on shaped dies, doing a job that normally takes hours, in a matter of minutes. Electrically operated.

This remarkable new tool, of which hundreds are in daily use, is inexpensive to buy, easy to use and produces excellent results at great savings of time and money. Has many other uses and will be found an invaluable aid in mill maintenance repair shop work. Get the facts today and ask for a demonstration.

Nord International Corp.

P. O. BOX 44W, DENVILLE, N. J.

The obvious advantages of this type of operation are much better control in the production operations by the producer and a great deal of convenience to the ultimate user in that the shipments to them are only enough to be counted on the fingers of both hands and of course the elimination of receiving, storage and other related problems.

Develop Economic Method for Welding of Copper and Aluminum Tubes

The Taylor-Winfield Corporation has developed a mass-production technique for the resistance welding of copper and aluminum tubing which may find broad application in the electrical, refrigeration, building, plumbing and machinery fields. Welding non-ferrous, dissimilar metals has been possible for a long time, but economically welding copper to aluminum tubing —perhaps the most difficult combination—has achieved a new production high following the design of equipment that is said to be outstanding in precision and consistency. Welds that meet most any production requirement are possible in flat or round stock, but welding tubing used in refrigeration is most common as a high production, cost-cutting process.

★ ★ ★

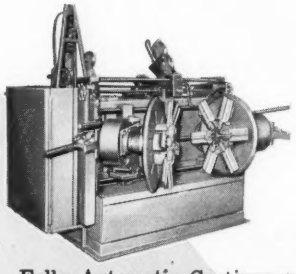
Joints in refrigeration tubing must be pressure tight to contain gas. Short lengths of copper tubing are welded to aluminum tubing to obtain the ease of making soldered connections to copper. In one application where one weld in 1,000 was considered acceptable as a reject ratio, 11,000 welds were made without a failure. The equipment is capable of producing quality welds in the aluminum-copper combination, economically, because it is specially designed and constructed for this particular purpose.

★ ★ ★

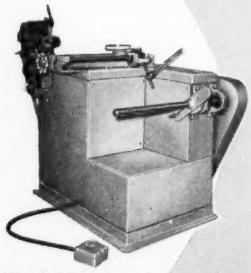
The company states that much development work has gone into the Taylor-Winfield equipment that consistently makes flash-butt welds of copper and aluminum in commercial quantities of acceptable quality. Tested samples of 7/16 O.D. tubing with .050 wall thickness answer all questions as to quality — gas-tight, mechanically sound and produced at a rate of up to 800 joints per hour when short lengths are welded. The clamps used with long lengths on the welder are so designated that there is a minimum of marking on the finished product and no slippage in the dies, without backups. The alloy steel welding dies can be so shaped and spaced as to pinch up the outer flash, resulting in very little effort to remove this flash. The machines for welding copper-aluminum tubing joints combine the highly accurate repetitive action of flashing, using a motor driven generated cam with a high speed double pressure air upsetting mechanism. A number of production installations has proven the desirability of the parts produced.

FOR FASTER MORE EFFICIENT WIRE PRODUCTION . . . .

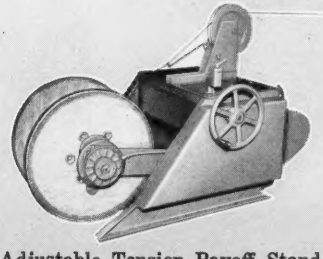
W I M EQUIPMENT



Fully Automatic Continuous Coiler and Respooler



Variable Speed, Constant Footage Respooler



Adjustable Tension Payoff Stand

Designed for more efficient wire production, WIM equipment is engineered to save you time, money and effort. Smooth high speed performance is assured. Continuous dependable operation is featured. The result is a line of wire handling machines that will handle your toughest jobs with little or no servicing. Write today for further information. Our engineering staff will be glad to help work out your problems.

W I M

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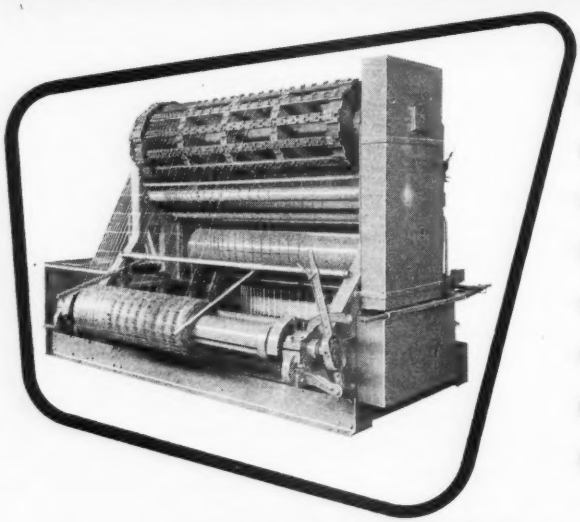
Division of Machinery Electrification, Inc.

98 UNION STREET WORCESTER 8, MASS.

Interlocking FENCE LOOMS



- Fastest — Most Efficient
- Preferred by Leading Mills
- Low Maintenance Cost
- Wrapped Stay Fence
- Straight Stay Wires
- Integrated — Space Saving
- Replaceable Main Bearings
- Single or Double Strands
- Years of Low Cost Production

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Specialists In Fence Looms

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Mesh widths $^1/_4$" - 4"
Working widths 3' - 12'
for wire BWG 22 - 13$^1/_2$

Model TUDN

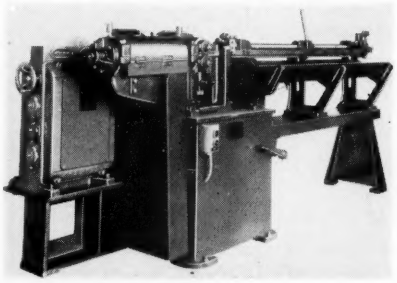
SINCE **MALMEDIE** 1873

MASCHINENFABRIK GMBH DÜSSELDORF / GERMANY

New Variable Speed Drive Automatic Wire Straightener and Cutter

A new "Shuster," the 1AV, has been added to the well known line by **Mettler Machine Tool, Inc.,** 132 Lawrence St., New Haven, Conn., manufacturers of Shuster Automatic Wire Straighteners and Cutting Machines.

★ ★ ★



New Shuster 1AV.

The 1AV features a variable speed drive geared to feed infinite speed changes from 50 to 200 feet per minute. Because the one machine will handle both basic and spring wire, it has exceptional versatility. Diameters from 3/32" to ¼" basic wire may be straightened and cut and, without further adjustment than turning the control handle of the variable speed drive, spring wire to ⅛" diameter may also be run through.

★ ★ ★

The variable speed drive enables the operator to compensate for differences of temper, alloy and size and still maintain peak productivity. On the job adjustment of speed is possible to provide a feed best suited for the work and the needs of the operator. Work fatigue is thereby minimized. Simple, economical operation with standard Shuster features of sturdy construction, extreme rigidity and ease of maintenance guarantee the new 1AV Shuster long service life and high production.

★ ★ ★

Other products manufactured by Mettler Machine Tool, Inc., include a complete line of Shuster wire straightening and cutting machine to handle sizes from .025" to 11/16" dia., tube, bar and shaped stock straighteners and reels.

Sheet & Tube Acquires Pipe Concern

The Youngstown Sheet and Tube Company announced today the acquisition of an interest in the Perrault Fibercast Corporation of Tulsa, Oklahoma. This concern, which in the future will be known as The Fibercast Corporation, manufactures glass fiber-reinforced thermosetting plastic pipe. This product, which is marketed under the trade name "Fibercast" has wide application where full corrosion resistance is required. It will be distributed through Continental Supply Company, The Youngstown Steel Products Company and The Youngstown Steel Products Company of California.

Hydraulic Straightening Machine For Metal Reels and Spools

Straightening of metal spools and reels up to 36 inches diameter and 24 inches traverse with flanges ½ inch thick, is possible with a flange straightening press developed by **Ross & Company,** 1401 East 57th Street, Chicago 37, Ill.

CLEAN, GRAY
Finishing Materials for Non-metallic Sheath Cable and Service Entrance Cable

FOR the first time CARBRO #1995 gives you a FLAME-PROOF hot-melt GRAY thermoplastic finisher compound. It meets UL requirements and assures a through-and-through gray finish that will not disfigure walls even if the lacquer coat is penetrated. Its use can eliminate a number of intermediate operations.

CARBRO #1852 is an ideal gray lacquer for use in combination with #1995 or with other finishers.

CARBRO #1995 Hot-Melt Thermoplastic Gray Finisher

Specific Gravity 2.29
Melting Point 163°F (B & R) ASTM D-36-26
Penetration 8 (100 grams at 77°F) ASTM D5-25
Packed in 400-lb. light gauge non-returnable drums.

CARBRO #1852 Gray Lacquer

Specific Gravity 1.85 to 1.95
Nonvolatile 75% to 82%
Packed in 5-gal. pails, 50-gal. agitator drums.

We will be glad to send samples of either of the above to your personal attention.

OTHER CARBRO PRODUCTS ARE: FLAME-PROOF SATURANTS; COMPLETE LINE OF PAINTS AND LACQUERS IN FULL RANGE OF NEMA CODE COLORS FOR REGULAR BUILDING WIRE.

Catalog upon request

CARBRO CHEMICAL CO. Established 1939
DUNNELL LANE, PAWTUCKET, RHODE ISLAND

ANOTHER PICKLING TANK READY FOR LONG SERVICE LIFE

Sheet Neoprene Rubber-Lined Pickling Tank.

- **LONGER SERVICE LIFE** assured in your lined acid tanks by our many years experience in selecting and applying the best lining for your specific requirements.
- **COMPLETE FABRICATION FACILITIES** coupled with our wide experience enables us to offer you complete tank units ready for installation.

RUBBER • KOROSEAL* • LEAD • PLASTICS

CHEMICAL-PROOF LININGS · TANKS HEATERS PLASTICS

OTHER HEIL PRODUCTS INCLUDES: Monel Pickle Hooks • Lead Steam Jet Agitators • Solid Plastic Duct Systems • Nocordal** Impervious Graphite External Heat Exchangers • Acid-Proof Maintenance Materials for Exterior Applications • Lead Fabrications

HEIL PROCESS EQUIPMENT CORPORATION

12901 Elmwood Avenue • Cleveland 11, Ohio

Write Today for Illustrative Literature
Representatives in all Principal Cities

* Product of the B. F. Goodrich Co.

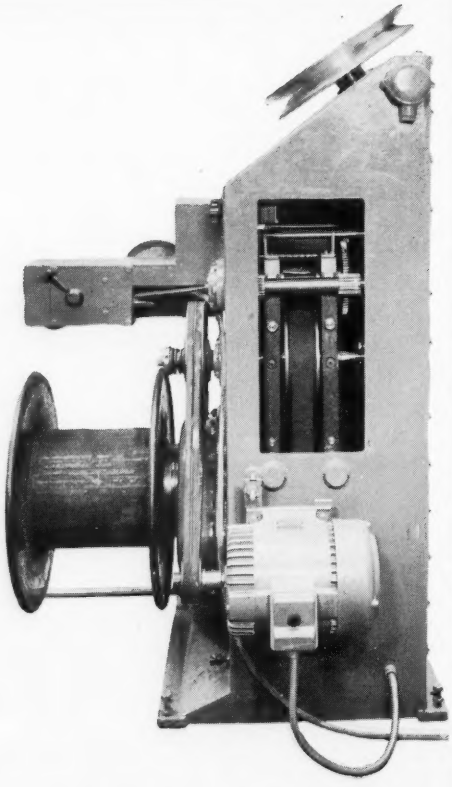
** Trade Name

POURTIER SHOWS TO U.S.

his Take-up for Tinned Wires

- Instead of receiving in coils the tinned wire, you will save one rewinding operation by using our patented device. You will receive directly on drums up to 30", wires from 8 to 22 Awg.
- Constant linear speed: no capstan, no contact on the drum. The regulation is obtained by 90° around a pulley. This pulley acts on an automatic speed-changer at each new spiral of wire. This pulley is itself driven through a regulated friction and irreversible gears. No excessive tension, even on the fine wires.

Speed regulated from 60 to 200 yards/minute. Discharge of full drum by pneumatic jacks. Traverse adjustable in speed and width, positively linked to the rotation of the drum. Dimensions: 3′ x 3′ x 4′ Weight: 600 lbs. Supplied with 3 HP motor, electric equipment and counter.



POURTIER MACHINES

153, rue Gallieni, ROMAINVILLE (Seine) FRANCE

This press is a stress relieved steel weldment accommodating a wide range of reel sizes. Ram speed is 60 inches per minute with 20 tons force; the hydraulic system is driven by a 5 horsepower motor and operates at 1250 pounds per square inch. The entire unit is self contained, occupying 28 by 34 inches floor space.

★ ★ ★

A descriptive circular is available from the manufacturer or their eastern representative, The Silvers Machinery Company, 441 Lexington Avenue, New York 17, N. Y.

Wire Machinery Concern Exhibited at Brussels

Maschinenfabrik K. A. Niehaus, (22a) Dusseldorf-Rath, Germany, was among those who participated in the Third European Machine Tool Exhibition in Brussels from September 4th to the 13th.

★ ★ ★

The company showed and demonstrated three pieces of equipment: 1) A high speed stranding machine of tubular design made to accommodate 16″ reels, complete with pay-out and take-up stands; 2) A bunching machine; and 3) A high-capacity high speed strander of tubular design for reels of 4″ diameters, suitable for stranding fine steel and copper wires of 0.1 to 0.3 mm diameter. This machine operates at approximately 5000 R.P.M.

★ ★ ★

The Exhibition was well-attended and considered highly successful.

Large Nickel Consumer

During recent years the stainless steels have provided a steadily growing market for primary nickel. Increases in nickel consumption have been especially marked in the United States where in 1952 the stainless steels required more nickel than was consumed in any other single field. Much of the recent demand for these steels has come from the defense programs. Many of the ordinary peace-time uses were restricted under government controls.

Offers Welding Machine Circular

Ames Spot Welder Co., 1328 58th Street, Brooklyn 19, N. Y., has issued a new circular covering various types of spot and butt welding equipment made for butt welding wire, tubing and sheet, and for spot cross-wire welding and other product fabricating jobs.

★ ★ ★

The company is in a position to produce special purpose welders and make special electrodes and dies for any welding operation, single or multiple, besides carrying a stock of standard electrodes and tips.

★ ★ ★

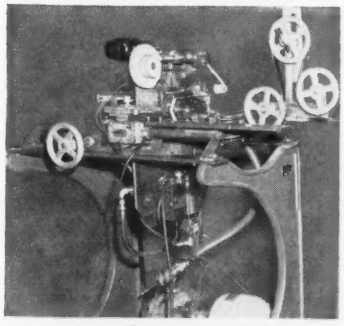
Facilities are also available for the maintenance and service of welding equipment and for the engineering of welding machines to perform special operations, including counsel on product design to secure the most economical production.

★ ★ ★

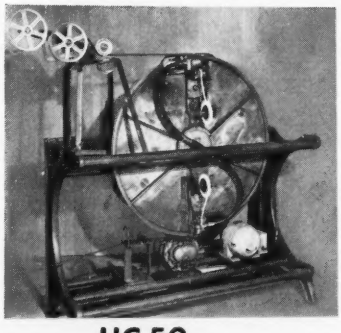
Their welders are adapted to all metals, both ferrous and non-ferrous. Ask for circular entitled: "For 16 Reasons Read This . . ."

NEW! Automatic Flag Labeler!

APPLIES EITHER FLAG OR BRACELET PRESSURE SENSITIVE LABELS IN CONJUNCTION WITH ANY TYPE CUTTING AND STRIPPING MACHINE.



FA 200 - LABELER



UC 50

IMPROVED CONTINUOUS WIRE LABELER

CUTS PRODUCTION COSTS

1. REDUCES DOWN TIME
2. USES MORE ECONOMICAL LABELS

Write for Prices and Further Information

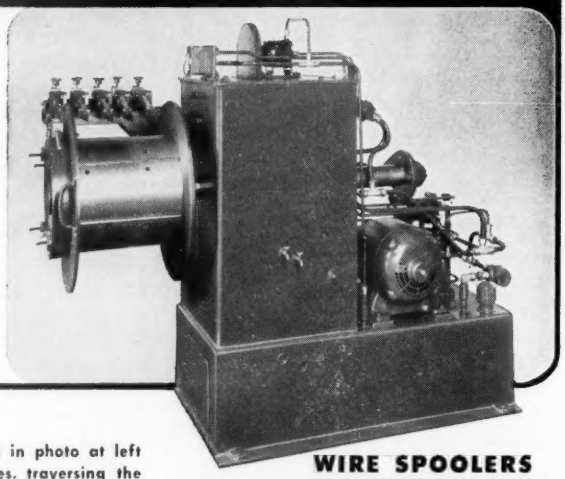
DEWYER INC., Box 272, Libertyville, Ill.

During the Wire Convention in Nov.
Call Collect LI 2-1477
For Demonstration

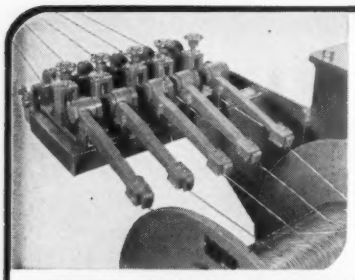
COIL 5 STRANDS IN 1 OPERATION

SECO TRAVERSE REEL SPEEDS UP PRODUCTION

This new SECO Traverse Reel winds five separate coils of flat wire or narrow strip *at the same time.* Coils are oscillated-wound, permitting much longer lengths than conventional ribbon-wound coils. Smooth, powerful hydraulic operation gives coiling speeds as high as desired, accurately controlled from zero to top running speed.



WIRE SPOOLERS
Single and Multiple type. Speeds up to 4,000 feet per minute.



Method of coiling is shown in photo at left The complete block oscillates, traversing the wire into five 3" wide coils. Traverse and tension control are extremely accurate. 1/8" to 1/2" wide flat wire can be wound. Block has 16" inside diameter and 24" outside diameter.

Call or Write for Information and Complete Data — No Obligation

STEEL EQUIPMENT CO.
P. O. Box 737, Warrensville Station, Cleveland 22, Ohio

SECO

DIE GARD 80, DIE GARD 84, DIE GARD 89, DIE GARD 34, DIE GARD 36, DIE GARD 43,

New Booklet Describes Electronic Design and Production Facilities

Manson Laboratories have just released an 8-page booklet describing their facilities devoted to special projects for the design and production of electronic and electro-mechanical instruments for laboratory and industrial use. A number of their projects are illustrated, and pertinent data are given regarding their specifications and performance.

★ ★ ★

Manson's services are especially useful to organizations requiring special instruments or control devices not available commercially, as well as to those not equipped for certain types of production runs or with overburdened facilities. Manson assumes entire responsibility, if desired, from the statement of the problem to delivery of one to ten thousand finished units.

★ ★ ★

Notable among the Manson products described and illustrated are: regulated D-C power supplies and high-frequency pulse and multiple-pulse generators with a wide variety of characteristics; transmitting-tube checkers and modulators for testing magnetrons, pulse, and microwave components at all power levels up to 40 megawatts peak power; and test equipment for the wire and cable industry.

★ ★ ★

Copies of the prospectus and further information can be had on request to MANSON LABORATORIES, 207 Greenwihc Avenue, Stamford, Connecticut.

Announces New Nail Merchandiser

Introduction of a new self-service merchandiser for aluminum nails, the first of its kind in the nail industry, is announced by Reynolds Metals Company, through its Building Products Division in Louisville, Kentucky. The attractive, brightly-colored display stand makes it possible for the small retailer to go into the nail business with a minimum investment. It holds 20 packages of aluminum nails in an assortment of the 14 most popular types and sizes.

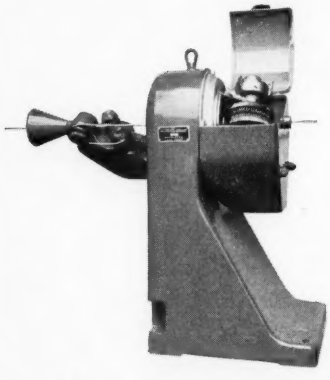
★ ★ ★

The paperboard merchandiser reaches the retail outlet in the shape of an ordinary corrugated board carton. By simple cutting and folding, it is quickly transformed into the self-selling merchandiser. An eye-catching display card is included for easy mounting atop the display stand. Set up and filled with packaged nails, the merchandiser measures 36¾ by 14 by 13 inches, and weighs 36 pounds.

★ ★ ★

Reynolds believes that the introduction of this compact point-of-sale merchandiser offering a complete selection will further develop the already fast-growing market for non-rusting, non-staining aluminum nails.

LINÉ-GORCY
MECHANICAL
WIRE ROD DESCALERS
(Patented in U.S.A.)



Built for—
Efficient
Low Cost
Dry Cleaning of
Hot Rolled Rods

Announcement!

Fisher Associates
Sole American Distributors
of the
Liné-Gorcy Rod Descalers
announce
their
appointment
as
Exclusive Distributors
of the
Wemco Molten Metal Pump

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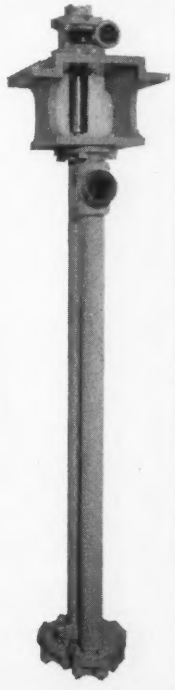
WEMCO MOLTEN METAL PUMP
(Made in U.S.A.)

Air Driven
for
Rapid Transfer
of
Molten
ZINC
LEAD
ALUMINUM
TIN
THEIR ALLOYS
and
HEAT TREATING
SALTS

Built
for
Intermittent
or
Continuous
Usage



REELS AND SPOOLS . . . 6" TO 110"

FOR WIRE ROPE, CABLE OR WIRE . . .

. . . ASSEMBLED OR KNOCKED DOWN

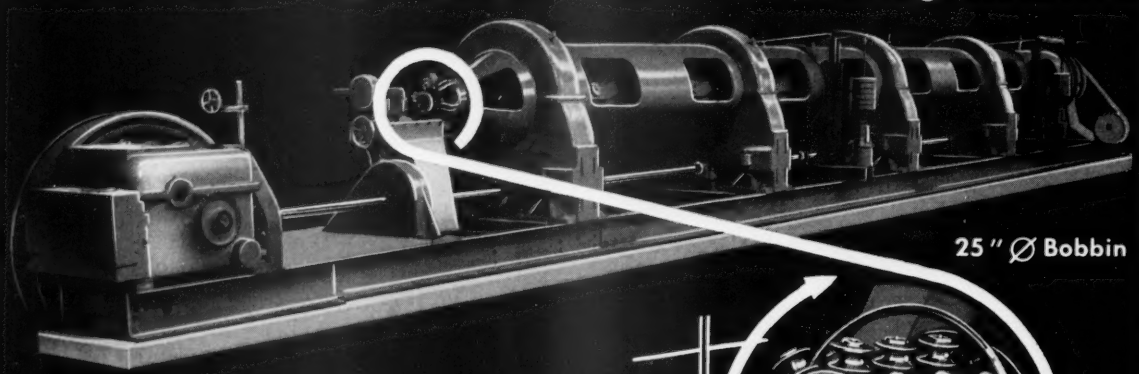
THE NELSON COMPANY

1015 STANDARD OIL BUILDING • BALTIMORE 2

SPECIALISTS IN SPOOLING OF WELDING WIRE

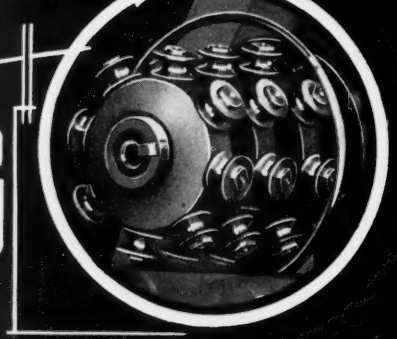
PINE • SPRUCE • PLYWOOD • WOOD FIBER and PAPER CONSTRUCTION

NIEHAUS High-Speed Tubular Stranding Machine



WIRE STRANDING
ROPE CLOSING
CABLE MAKING

MACHINES



Engineer agent invited

MASCHINENFABRIK K. A. NIEHAUS • GERMANY
DÜSSELDORF-RATH

Components of Wire Drawing Lubricants

(*Continued from page* 1058)

for difficult dry drawing operations.

★ ★ ★

Soaps made from inorganic alkalies, such as the ones mentioned above, leave a residue after heat decomposition or burning. Where a soap is desired that will burn off completely in an annealing furnace, an organic alkali such as triethanolamine may be used. These soaps, however, are only of the soft variety and will tarnish copper and its alloys.

★ ★ ★

Soaps made from fatty material which have a minimum number of double bonds (largely saturated molecules), such as tallow or hydrogenated fish oil, give harder soaps with higher melting points than soaps made from corresponding unsaturated fatty materials. The raw fatty material used in the manufacture of soaps may be either fatty oils, fats, or fatty acids. (The process of soap formation is called "saponification".) Where fatty oils and fats are used in the manufacture of soap, glycerin will be a by-product of the reaction as illustrated below:

★ ★ ★

$C_3H_5(C_{17}H_{35}O_2)_3$ + 3 NaOH ⟶ 3 $NaC_{18}H_{35}O_2$ + $C_3H_5(OH)_3$
Fat (Palmitin) — Sodium Hydroxide — Soap—(Sodium Palmitate) — Glycerin

$C_{17}H_{31}COOH$ + NaOH ⟶ $NaC_{18}H_{35}O_2$ + H_2O
Palmitic Acid — Sodium Hydroxide — Soap—(Sodium Palmitate) — Water

★ ★ ★

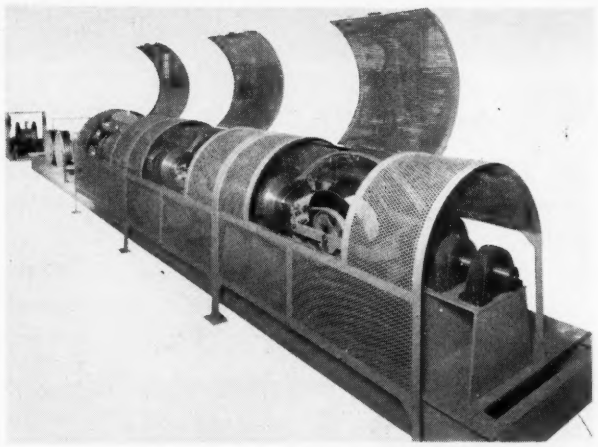
In the manufacture of wire drawing "soaps" it is quite usual to incorporate "additives" in the lubricant. In addition, there may be certain materials present as contaminants. Among additives and contaminants present in soap lubricants are the following: lime, chalk, mica, fat, free fatty acids, water, free alkali, defoamants, extreme pressure chemicals, detergents, waxes, glycerin, unsaponifiable material from fat, perfumes, etc. This long list cannot emphasize too strongly that two "soap" lubricants prepared by different manufacturers and described, for example, as "calcium stearate" may vary considerably in performance characteristics. For further details on this subject I will refer you to my article in the November 1952 edition of WIRE AND WIRE PRODUCTS, entitled, "What are the Differences in Wire Drawing Lubricants?"

Scovill Mill Division Patents Trademark

The Mill Products Division of Scovill Manufacturing Company, Waterbury, Connecticut, has adopted a distinctive trademark to identify its various products. This trademark has been authorized by The United States Patent Office.

★ ★ ★

HIGH SPEED WIRE TWISTING MACHINES



Illustrated is the EDMANDSCO 4-WIRE TWISTER, equipped with Filling, Serving and Taping attachments. A 4-speed gear box, working through a hydraulic clutch, gives flyer speeds of 173,270,450 and 800 RPMs.

This machine is made in two sizes, taking reels up to 36" x 18" and up to 30" x 16". Will twist wires from No. 22 to 1/2" in diameter. Has double capstans.

A full line of twisting machines and accessories are available. Write for literature and prices.

THE EDMANDS COMPANY

228 ABORN STREET — **(Tel.: GAspee 1-6175)** — **PROVIDENCE 3, R. I.**

This insignia, designed by **C. P. Goss,** vice president in charge of mill sales, consists of three color bands in brass, bronze, and nickel silver. These bands represent the basic colors of products made by this Scovill division.

★ ★ ★

The Waterbury concern, America's oldest brass company, was founded in 1802 for the production of metal buttons. Since then, it has grown to be one of the largest metal producers and fabricators in the country, turning out thousands of different light metal items using copper, brass, aluminum, steel, and nickel alloys.

★ ★ ★

Since its first use in January, 1948, the three color trademark has been incorporated on the mill products shipping labels, tags, salesmen's calling cards, souvenir matchbooks, and last year it was made into a club tie using the three colors as regimental stripes. The trademark also was used on Scovill's 1952 Annual Report cover.

Beryllium and Its Alloys Described in New Booklet

Beryllium products including the pure metal, oxide and alloys, are described in the BERYLCO Product Directory, a 20-page booklet recently published by The Beryllium Corporation, Reading, Pennsylvania. A pioneer in the development of this unusual metal, The Beryllium Corporation maintains the most highly integrated facilities in the industry and is the world's leading producer of materials incorporating the element beryllium.

★ ★ ★

Because of its wide use in our newest industries—such as nuclear energy and electronics—beryllium has been named the metal of progress. In most applications it is alloyed with other metals to greatly enhance their mechanical properties.

★ ★ ★

The most widely used alloy is beryllium copper containing 2 percent beryllium, which can be heat treated from a soft workable metal to high levels of strength, hardness and fatigue resistance.

★ ★ ★

Beryllium copper's extraordinary spring properties, together with its excellent electrical conductivity, have favored its use in current-carrying springs and contacts in electrical equipment of all types. Its fatigue resistance is used to advantage in diaphragms and bellows for instruments and controls of many kinds.

★ ★ ★

The Berylco Product Directory covers in concise form the various commercial products offered by The Beryllium Corporation. These include beryllium master alloys, beryllium copper wrought products, beryllium casting ingots and other Berylco products such as castings, nonsparking tools, forgings, beryllium oxide, beryllium metal and ferro-beryllium.

★ ★ ★

KENMORE METALS
CORPORATION

JERSEY CITY NEW JERSEY

manufacturers of stainless steel and preplated wire

Kenmore Metals Corp. brings to the fabrication of stainless steel and preplated wire, and to its many other special purpose wires, unsurpassed technical know-how, and unswerving adherence to the highest standards of quality and service. Modern thinking and alert engineering are combined to serve the needs of industry with specialty wire "tailor-made" to the most exacting specifications.

Kenmore Stainless Steel Wire Kenmore Stainless Steel Wire

Yes, we really mean it

!!!!
IF YOU HEARD PEOPLE YOU KNOW SAY—
THE AMES SPOT WELDER COMPANY . . .
. . . helped increase their volume of production
. . . lowered operating costs
. . . which doubled their profits over old methods
Wouldn't you feel that in all fairness to yourself and to your future, that you should at least give the Ames Company an opportunity to prove the same for you?
THAT'S EXACTLY HOW WE FEEL!

We manufacture all sizes of resistance welders for all applications of both ferrous and non-ferrous metals in wire mills and the wire-fabricating industry.

Whether it be aluminum, wrought iron, stainless steel or chrome rod, wire or tubing, we can give you the answer to welding your product with new techniques.

We carry a complete stock of standard electrodes and accessories to meet your requirements. Special purpose dies can be designed upon your request.

If you have welding problems or require replacement parts with service, put 30 years of Ames Welding experience and a half million dollar plant to work for you.

For complete information, write to

AMES
SPOT WELDER CO., INC.

Resistance Welder Manufacturers
Since 1923

1328-58th Street
BROOKLYN 19, N. Y.

New Silicone Resin Versatile

A single silicone resin can now be used for a variety of insulating applications which ordinarily require several different materials. Called SR-17, the new insulating varnish developed here by the General Electric Company's silicone products department possesses an unusual combination of heat resistance, low temperature flexibility and high bonding strength.

★ ★ ★

SR-17 should simplify inventory problems for electrical equipment manufacturers, G. E. says. Multiple uses for the one product include coating glass cloth for Navy power cable and Class H insulation, providing a tough bond for flexible mica tapes and coil wrappers, treating glass sleeving, and impregnating asbestos for layer insulation.

★ ★ ★

Aside from the electrical field, the properties of SR-17 indicate its use as a resin base for protective and decorative paints requiring heat and weathering resistance. It is compatible with many other types of silicone resins in use today, the announcement said.

★ ★ ★

With SR-17, requirements for both high temperature insulation and low temperature flexibility can be met by altering the cure rather than by changing resins, General Electric says. For high temperature applications, SR-17 coated on glass cloth is cured 15 to 30 minutes at 250C. When flexibility at low temperatures is desired, a cure of 20 to 30 minutes at 300C is recommended.

Tungsten—Its Metallurgy, Properties and Applications

A new book by **Colin J. Smithells,** D.Sc., published by Chemical Publishing Company, 212 Fifth Ave., New York 10, N. Y. 400 pages; price $8.50.

★ ★ ★

This all-embracing book on the metallurgy, chemical and physical properties, and industrial applica-

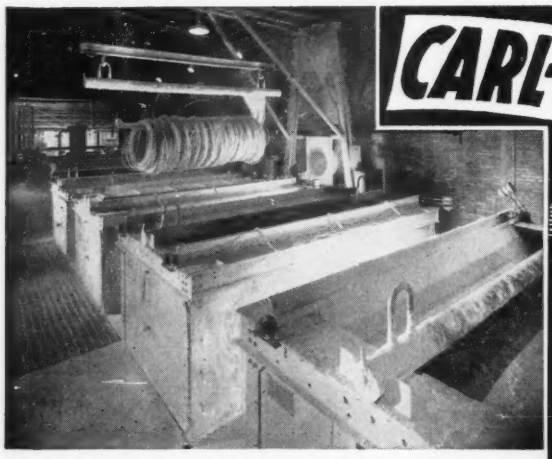
BUNCHING
(TWISTING)
AND
STRANDING
IN THE WIRE AND GENERAL MANUFACTURING PROCESSES

SPECIALIZED ENGINEERING
AND
SPECIALIZED FACILITIES
AT YOUR SERVICE

Expanding application of twisting principles to the production of many products is reflected by an ever-increasing demand for both H-D standard equipment as well as machines especially engineered to solve varied production problems. Week after week surprising new uses are developed through the close cooperation of our engineering department with manufacturers in many fields.

Write today for our New Technical Bulletins. Tell us what you make—or contemplate making and your inquiry will receive prompt attention.

HASKELL-DAWES
MACHINE CO., INC.
2231 E. ONTARIO ST.
PHILADELPHIA 34
PA.



CARL-MAYER

HI-SPEED REGISTERED

ROD BAKERS

PATENT Nos.
U.S.A.
2,235,559
2,296,361
2,323,828
CANADA
396,144
401,589

ALSO OTHER TYPES OF INDUSTRIAL OVENS AND FURNACES

GREATER SPEED AND FUEL ECONOMY PROVES OUTSTANDING ENGINEERING

Carl-Mayer Hi-Speed Rod Bakers have an exclusive heating arrangement, combining faster baking with amazing fuel economy—and a patented Blow-Off feature which removes moisture without bumping or agitating the coils. *WRITE FOR BULLETIN NO. 350.*

SERVING CONCERNS LIKE THESE:

American Steel & Wire Co.
Atlantic Wire Co.
Atlas Steel Co.
Atlas Tack Corp.
Babcock & Wilcox
Canadian Steel Corporation.
California Wire Cloth Corp.
Colorado Fuel & Iron Corp.
Crucible Steel Co. of America
Eaton Manufacturing Co.
Frost Steel & Wire Co., Ltd.
B. Greening Wire Co., Ltd.
Gary Screw & Bolt Division of Pittsburgh Screw & Bolt Corp.
Hollup Corp.
Indiana Steel & Wire Co.
Johnson & Nephew, Ltd.
Jones & Laughlin Steel Corp.
Page Steel & Wire Co.
Pittsburgh Tool Steel Wire Co.
Republic Steel Corp.
Steel Co. of Canada

THE CARL-MAYER CORPORATION

3030 EUCLID AVENUE
CLEVELAND, OHIO

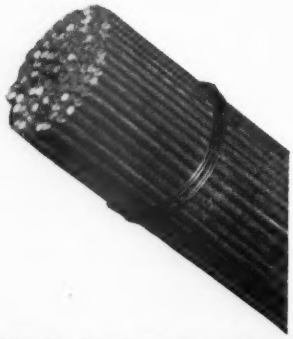
finish · temper · gauge · length

SHIPPED TO YOUR SPECIFICATIONS...

CALWICO

STRAIGHTENED AND CUT WIRE

Applicable to a wide variety of end uses, CALWICO Straightened and Cut Wire is your best buy. For complete information mail the coupon below.



The Colorado Fuel and Iron Corporation
Pacific Coast Division
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CALWICO STRAIGHTENED & CUT WIRE
THE COLORADO FUEL AND IRON CORPORATION CF&I

tions of tungsten will be welcome to all technical workers who use this versatile metal.

★ ★ ★

The introductory part gives an outline of the mineralogy of tungsten. The primary and secondary treatment for the production of metallic tungsten, the working of tungsten for obtaining various ductile products, the metallographic structure of the pure metal, the influence of manufacturing operations on the physical properties of tungsten, the most important tungsten alloys and their industrial applications, chemical and spectrographic methods for the determination of impurities are among the many topics discussed in detail. The author enlisted the help of several experts for writing the chapters on the special phases of the subject.

★ ★ ★

The book contains 225 illustrations, among them many photomicrographs. The numerous tables list many helpful data. It is well written and should be of considerable assistance to beginners and specialists alike.

New Vinyl Resin Announced

A new vinyl resin, designed for dry blend feed of extruded products such as wire jacketing, tubing, welting, garden hose and similar products, has been developed by the Naugatuck Chemical Division, United States Rubber Company.

★ ★ ★

Dry blend feeding has been gaining in importance, since it is a fast and economical method for fabricating extruded plastic products. Labor and machinery costs are reduced with this method, since it does not require the use of internal mixers or open mills.

★ ★ ★

The new resin, known as Marvinol VR-22, is a straight polyvinyl chloride resin of high molecular weight. It rapidly absorbs plasticizer in heated mixers and gives a dry, free flowing mix of high uniformity. In addition to use in conventional dry blend equipment,

it can also be used in open mills or Banbury mixers for calender operations.

★ ★ ★

Marvinol VR-22 won't bridge or pack in the extrusion feed, and has a fast drying time that allows mixing cycles to be speeded up. It also fuses quickly, giving extrusions that are smooth, uniform, and free of "fish eyes."

★ ★ ★

VR-22 can be formulated with high amounts of plasticizer of varying types, tests indicate. Tests also show that compounds made from it have excellent inherent heat stability and because of its high molecular weight excellent resistance to heat deformation and compression under load.

★ ★ ★

The new resin was developed after extensive research in the Naugatuck Chemical laboratories. It is now in quantity production, and available to vinyl fabricators.

ASTM Standards on Copper and Copper Alloys

This book brings together in convenient up-to-date form all of the ASTM Standards pertaining to copper and copper alloys, which were developed by Committee B-5 on Copper and Copper Alloys, Cast and Wrought, and other ASTM technical committees. It is the direct result of the close cooperation of the technical representatives of leading producers and consumers of copper and copper alloys serving on these committees.

★ ★ ★

The 1953 edition includes in their latest form 115 widely used ASTM standards, including 102 specifications; 9 test methods; 2 recommended practices—one for tension test specimens for copper-base alloys for sand castings, the other for designating significant places in specified limiting values; and 2 classifications—one for cast copper-base alloys, the other of copper. A high percentage of the material included in the earlier edition has been revised and four of the methods are new.

★ ★ ★

VINYLS for...

CRITICAL CUSTOMERS

For the past ten years we have specialized in the compounding of Vinyl extrusion and injection molding compounds to specifications, or developing compounds for a specific use.

Underwriters' approved standard compounds are available in all colors for POT, T, TW, 80 Degree C, 90 Degree C and 105 Degree C wires.

Save your plant space for wire processing equipment. Let us tailor your compounds to bring out the special properties you require.

Your inquiries are invited.

ELECTRONIC RUBBER COMPANY

69 Sunnyside Ave. • Stamford, Conn.

"STEEL" says

"Yearly loss to Industry $6,000,000,000.00 from Corrosion."

The right application of the right material will cut your share of this multi-billion loss.

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is the right material.

Write us for information on its use and application.

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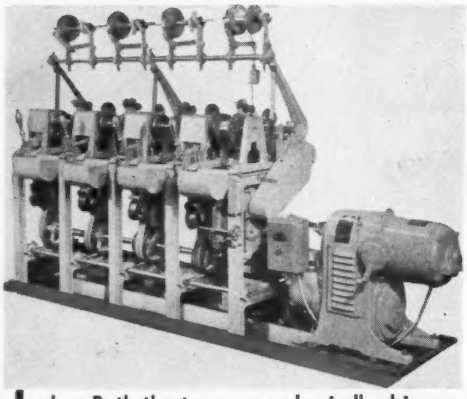


1900-HV MULTIPLE SPINDLE SPOOLER

SPECIFICATIONS
Size Range: .010" to .080" or heavier if soft and many flat wire sizes.
Max. Spool Size: 16" flange diameter.
Capacity: usually 4 to 8 spindles.

The 1900-HV Spooler is a rigid, precision machine which will consistently produce a uniform, dense wire lay. Both the traverse and spindle drives are regulated through wide-range, stepless, variable speed units, eliminating change gears. The 1900-HV is completely adaptable to your particular constant or changing demands. All controls are positive. Adjustments are made accurately with the spooler in operation and without tools.

Both smooth acceleration and rapid stopping is obtained through a single lever at each station. Spool changing is simple and rapid. Anti-friction bearings are used on all shafting and spindles.

Your special requirements can be incorporated into the design. Each machine is delivered ready for operation from your power supply. Payoff stands furnished as extras.

Consult us on your spooling problems.

ROBERT J. EMORY COMPANY
31 East Runyon Street Newark 5, N. J.

2 ELECTRIC PRODUCTIMETERS

"CS" and "Y"
ELECTRIC PRODUCTIMETERS
The answer to all electric counting requirements

Two Companion Counters . . . Two Sizes . . . Hi-Speed . . . Accurate . . . Long Life . . . Totally Enclosed

Speeds of 1000 counts per minute. Both counters give maximum readability. Design fits all mounting conditions . . . panel mounting or base mounting. Hardened steel working parts for long life and dependability.

New type case for compactness, rigidity, and protection against dust and moisture conditions. Operate accurately over wide current fluctuations.

DURANT MANUFACTURING CO.
1918 N. Buffum St. Milwaukee 1, Wis.
118 Orange St. Providence 3, R. I.
Representatives in Principal Cities

Write for "New Electrics" Bulletin

PRODUCTIMETERS SINCE 1879 *Count Everything*

Standards cover copper, copper alloy, and copper covered steel electrical conductors; non-ferrous metals; plate, sheet, strip, and rolled bar; rod, bar, and shapes; wire; pipe and tube; ingot; sand and die castings; filler metal; and methods of test for copper and copper alloys.

★ ★ ★

A group of specifications cover non-ferrous metals such as slab zinc; pig lead; nickel; phosphor; silicon; electrolytic cathode copper, and others. Also included are test methods covering expansion; mercurous nitrate; resistivity; preparation of micrographs; tension; hardness; sampling; and grain size evaluation.

★ ★ ★

Copies of this 556-page book can be obtained from Headquarters of the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. at **$5.00** each, heavy paper cover; and **$5.65** each, cloth cover.

★ ★ ★

Alloy Rods Company Builds Western Electrode Plant

E. J. Brady, president of the Alloy Rods Company, York, Pa., has announced that construction had started on a new plant of the company located in El Segundo, Los Angeles County, California.

★ ★ ★

The building site is situated near the Los Angeles International Airport, in the new industrial area now being developed by the Santa Fe Railroad.

★ ★ ★

The new plant, to be known as the Pacific Coast Division of the Alloy Rods Company, will produce a complete line of alloy arc welding electrodes to serve the entire Pacific Coast and Rocky Mountain States.

★ ★ ★

The plant, which is expected to be in full operation by October 1 of this year, will be under the supervision of **George M. Hohmann** who is now the production manager of the York plant.

★ ★ ★

Mr. Brady also stated that the present Alloy Rods Company plant in York is being enlarged to double existing production facilities. The Alloy Rods Company, leading manufacturer of alloy arc welding electrodes in the United States, was established in York 14 years ago and now produces approximately one-third of all stainless steel electrodes consumed in this country.

New Technical Bulletin Decribes Properties and Applications of "Teflon"

Latest word on woven glass fabrics impregnated and coated with "Teflon" tetrafluoroethylene resin is available in a new technical bulletin compiled by the Du Pont Fabrics Division.

* * *

Not only are the outstanding electrical and mechanical properties of these fabrics, tapes and laminates set forth in tabular form, but uses in other fields are also touched upon. The chemical and solvent resistance, high and low temperature characteristics, and anti-adhesive and anti-friction properties of various glass fabrics coated with "Teflon" suggest applications in the aircraft, chemical, food processing, packaging, paper, plastics, printing, rubber, textile, and other industries.

* * *

Copies are available on request to Du Pont Co., Fabrics Division, Room 812, 350 Fifth Ave., New York, N. Y.

Publishes New Catalog on Hard-Facing Electrodes

Alloy Rods Company, York, Pennsylvania has issued a new 12-page catalog in color on its lines of Wear-Arc hard-facing electrodes and Wear-Flame hard-facing rods, offered in nine and four basic types, respectively.

* * *

Intended for fast, efficient, and economical rebuilding and hard-facing for correction of wear patterns, Wear-Arc electrodes and Wear-Flame rods have applica-

IRONSIDES
SCIENTIFIC LUBRICATION
SHIELD PRODUCTS

Internationally known specialists

WIRE DRAWING LUBRICANTS

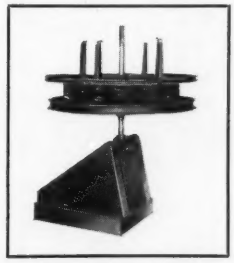
Our experienced staff of lubrication engineers is available for consultation without charge. Write us regarding your special lubrication problems.

THE IRONSIDES COMPANY

270 WEST MOUND STREET • COLUMBUS, OHIO

MOSLO "SHIFTWEIGHT"
COUNTER-BALANCED WIRE REELS

Takes the Manual Labor out of loading a Reel with Wire. **Just unlock the knurled spindle by a twist of the wrist, tilt the reel assembly 90°, roll coil of wire to reel, lift 6" on to centering arms, release lock by twist of wrist, use spindle as lever to lift, and the *Weighted Counterbalance does the rest!***



Immediate Delivery
$190.00 F.O.B. Cleveland

Capacity 300 lbs.—Min. Coil I.D. 10"—Max. O.D.—41".
All welded steel construction—Brake Equipped.

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FURNACES
for Annealing
Hardening · Drawing · Normalizing
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Batch or Continuous · Oil, Gas or Electric

Direct Heated
Muffle Type
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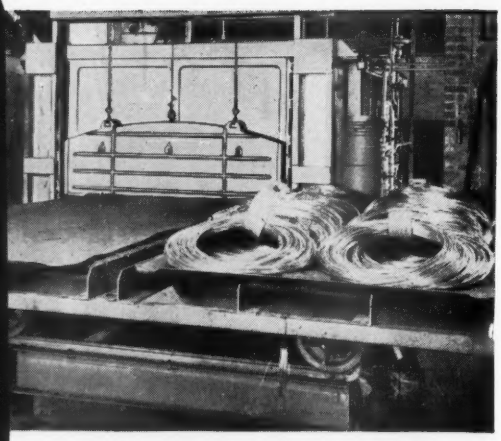

Gas-fired pan type furnace for annealing 5000 lbs. of medium gauge brass wire; furnace atmosphere controlled to produce oxide-free wire — in many cases practically bright. Other Rockwell furnace types include parallel tube, belt conveyor, pit, hood and others.

ROCKWELL SINCE 1888 BUILT
FURNACES · OVENS · SPECIAL MACHINERY
W. S. ROCKWELL COMPANY
242 ELIOT STREET · FAIRFIELD, CONN.
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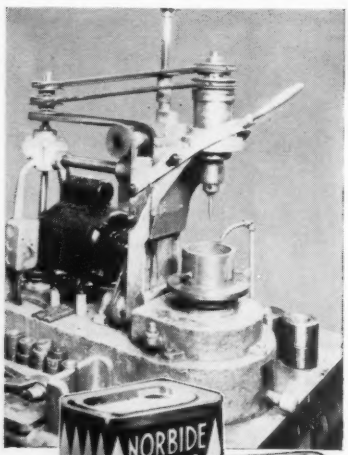


NORBIDE®
Abrasive
The Hardest Manufactured Abrasive for Cutting and Polishing Dies

One hundred fifty times less expensive than the diamond.

Norbide Abrasive—Norton Boron Carbide effectively rips and semi-finishes wire drawing dies—especially efficient on cemented carbides.

Catalog 559-W

NORTON COMPANY
WORCESTER 6
MASSACHUSETTS

NORTON® *Making better products to make other products better*

tions in: straight abrasion, abrasion and severe impact, abrasion and light impact, abrasion and compression, abrasion and corrosion, abrasion and heat; abrasion, heat and impact; and abrasion, heat and corrosion.

★ ★ ★

Catalog copy is written from the "how to do it" standpoint, and three pages are elevated to an "Application Guide" citing wear parts, types of wear, and the correct electrode or rod to use in 13 major industrial applications, on about 75 common types of hardfacing problems.

★ ★ ★

Copies of this Wear-Arc/Wear-Flame catalog may be secured by writing Alloy Rods Company, York, Pennsylvania and requesting Bulletin AR53-20.

Adds Non-Returnable Reel Heads To Line

William McCaskie, Inc., Forge Road, Westport, Mass., manufacturers of returnable reels of wood construction for wire and electric conductors, has installed new equipment for the construction of nailed-up non-returnable reel heads in diameters of from 12 to 58 inches.

★ ★ ★

The line of reels made by McCaskie heretofore have been made of the finest woods and plywood, some types metal bound, and all of glued and pegged construction, employing no nails.

★ ★ ★

Because of the demand for a less expensive non-returnable reel, these new reel heads are now being made to a design that will be sufficiently strong and serviceable for the purposes to which they will be put, yet cheap enough in cost so that they can be discarded after use.

A Lot of the Stuff

The record 10,168,000 tons of steel made in the nation's furnaces in March would make a solid block the size of the Empire State Building (37,000,000 cubic feet) and leave enough over for a 4,500,000 cubic foot block.

Westinghouse Breaks Ground for New Research Center

Westinghouse Electric Corporation broke ground in June for its new Research Center. **Dr. John A. Hutcheson,** Westinghouse vice president and director of research, turned the first shovelful of earth at a ceremony held on a 70-acre plot about 10 miles east of downtown Pittsburgh's Golden Triangle.

★ ★ ★

These new research facilities should be completed early in 1955, and will give Westinghouse the most modern Research Center in the entire electrical industry. It will be a place of beauty as well as efficiency, surrounded by trees and shrubs on well-landscaped lawns.

★ ★ ★

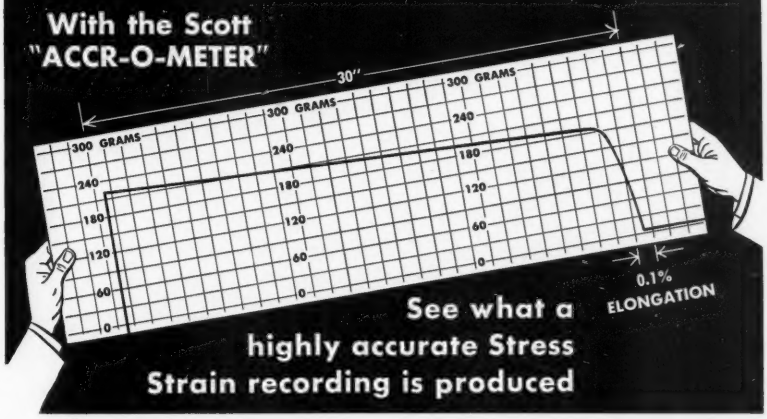
The Research Center will ultimately replace the present Westinghouse Research Laboratories located since 1916 only a few miles away from the new site. Of the present staff there only a small number will remain behind when it comes time for "the big move." For the time being, those who stay on at the old labs will continue research involving the use of special equipment such as that in the combustion laboratories, the 90-ton atom smasher and other equipment impractical to move. The giant, pear-shaped Van de Graaf generator, a familiar sight to motorists entering or leaving Pittsburgh's eastern city limits, will also remain at the old site.

Reprint Describes the Chevenard Thermobalance

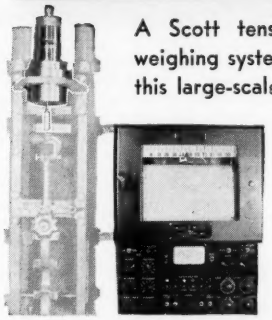
R. Y. Ferner Co., Malden 48, Mass., announces the availability of a reprint describing the new Chevenard Thermobalance for the continuous weighing of metals, chemicals or any industrial specimens during a heat treatment or exposure to corrosive influence. One of its most important functions is to disclose in terms of variation in weight a chemical transformation.

★ ★ ★

With the Scott "ACCR-O-METER"



See what a highly accurate Stress Strain recording is produced



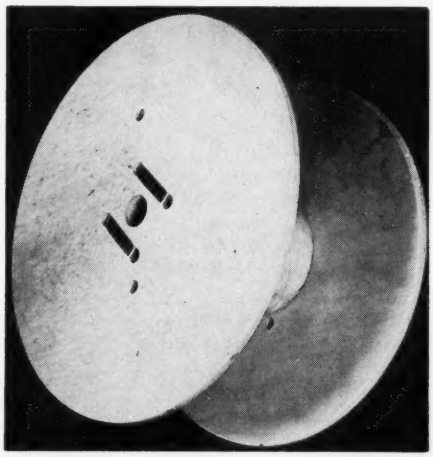
A Scott tensile tester, equipped with "Accr-O-Meter" weighing system for constant-rate-of-extension testing, gives this large-scale picture of a wire under test. The range of this particular unit was 300 grams but with slight adjustment the range can be increased up to 2,000 lbs. Request details of this newest weighing system, free from inertia, accurate beyond belief.

SCOTT TESTERS, Inc. 55 Blackstone Street Providence, R. I.

Scott Testers — Standard of the World

FINE PLYWOOD REELS

FOR WIRE



Made of air-dried wood, all parts secured with metal strapping. This reel is durable and strong. Heads cannot be dislodged by heavy side load pressures.

Reels shipped knocked down or assembled — metal strapping easily applied by standard metal fastening clips used for boxes, etc.

Heads have accurately fitted dovetail joints that give the reel extreme rigidity. Returnable and non-returnable types, made in head diameters of 6 in. to 22 in.

Shipped to any point in New England by truck

Get the facts on these fine reels

WINCHESTER REEL COMPANY, Inc.

ASHUELOT, N. H. **TEL.: WINCHESTER 163-2**

Our Products Carry Reel Loads.

There's Nothing Like A
NILSON
WIRE & RIBBON STOCK
REEL

for:

★ insuring continuous production.
★ reducing labor costs.
★ eliminating loss of time because of accidents.
★ easy replacement of parts.

3 Outstanding Types For Your Needs

1. *Tilting Reel* — unique construction eliminates need for overhead handling equipment. Simply loaded. One operator. Automatically locks itself in loading position as well as upright. Strong —Rigid. Comes in 3 models.
2. *Stationary Base*—Economical—Quickly changed to vertical position. Adjust to various heights. Three sizes—75 lb.—225 lb. coil.
3. *Clutch Reel* — A 4" oscillating movement compensates for sudden pull of feed. The most desirable if one operator handles several machines. No more feed slippage or feed length variations.

Illustration — The NILSON #51-B *Clutch Reel* Available in 150 lb. and 225 lb. coil.

Write Today for the NEW NILSON Wire & Ribbon Stock Reel Catalog

There's Nothing Like A NILSON

NILSON has been specializing in Forming Equipment for over 50 years.

THE A. H. NILSON MACHINE COMPANY
1516 RAILROAD AVENUE • BRIDGEPORT 5, CONN.

CHICAGO • CLEVELAND • DETROIT • LOS ANGELES • HAMILTON, ONT., CANADA

BETTER FINISH, LESS DIE WEAR with

PERMAG

WIRE DRAWING COMPOUNDS

Whether steel, brass, copper, galvanized or special wire, you can get a better product with a brighter, cleaner finish, even at faster draws, when you lubricate with PERMAG Wire Drawing Compounds.

Through their efficiency and effectiveness, PERMAG Wire Drawing Compounds reduce wear on costly dies, adding the advantage of substantial economy to the merits of faster production.

Whatever your wire drawing requirements, PERMAG engineers will assist you with the best possible lubricants to meet them. Inquire today without obligation.

MAGNUSON
PRODUCTS CORPORATION
50 COURT ST., BROOKLYN 2, N. Y.
In Canada: CANADIAN PERMAG PRODUCTS, Ltd., Mont.

This important instrument was developed by the famous physicist, Professor Pierre Chevenard, who has ..invented the Dilatometer, Thermobalance and many other instruments for basic research in metals, minerals, ceramics, glass, plastics, etc., has now given the chemical, minerals and nucleonic sciences an important aid for research laboratories.

★ ★ ★

The reprint on the Thermobalance and a list of Ferner machines and instruments for testing will be sent upon request.

IDA Publishes Booklet on Industrial Diamonds

The Industrial Diamond Association of America, Inc., at its Annual Convention at the Edgewater Beach Hotel, Chicago, in May, launched a new publication. It will be useful both to the layman and the man in the shop who has not too much time to read, but wishes to absorb some interesting information. The booklet is entitled "The Diamond That Pays For Itself." It is well illustrated to show the applications of industrial diamonds in ways curious to many, and throughout all segments of industry. Copies are available to readers of this magazine.

★ ★ ★

115 persons were present at the Convention; 20 Committees were reorganized and reports were made of exceptionally good progress in the field of Association usefulness to industry at large.

★ ★ ★

The Welding of Nickel Alloy Steels

Bulletin A-93 contains 44 pages, with tables, graphs and illustrations. It is a study of the various welding techniques, including some of the newer inert gas processes, electrodes, preheat treatments and post heat treatments. Typical results that can be expected are given for the low alloy high strength steels, low carbon and medium carbon engineering alloy steels, and special steels. Write to International Nickel, New York 5, N. Y., for a copy.

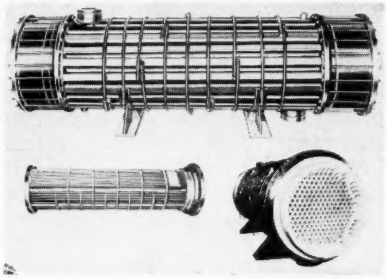
Adds Line of Heat Exchangers

A new standard line of pressure heat exchangers designed to pass corrosive liquids or gases under pressure at high temperatures through tubes or shell has been announced by **Haveg Corporation.**

★ ★ ★

Molded from Haveg, an acid-digested asbestos bonded with synthetic resins, and competitively priced, the new line offers distinctive advantages in extended service life and resistance to corrosion, according to **C. R. Runk,** Haveg sales manager.

★ ★ ★



Side and end views (top and lower right) show external construction of corrosion resistant standard pressure heat exchanger manufactured by Haveg Corporation, Marshallton, Del. A typical tube bundle for the unit is shown at lower left.

Standard pressure sizes range from 13¼ to 29¼ inches inside diameter with single or multi-pass interchangeable heads. Since the material is molded, larger sizes up to 10 feet in diameter can be made for coolers and low pressure heat exchangers.

★ ★ ★

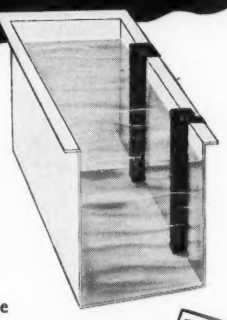
Pressure ranges of the new standard line are from 50 to 75 pounds per square inch with a wide margin of safety. Haveg is resistant to thermal shock and can safely be used continuously in temperatures up to 265°F.

★ ★ ★

The outer shell is reinforced with wood staves and steel hoops. Many types of packing are available, and gaskets of Neoprene, Teflon, rubber, or asbestos composition may be supplied to seal off the tube sheets. Auxiliary equipment, such as pumps, valves, pipe and fittings can be supplied in special corrosion-resistant Haveg grades.

*Glo - QUARTZ
ELECTRIC RADIANT IMMERSION HEATERS

Heat by far Infra-Red. The scientific application of heat to all plating, pickling and phosphatizing solutions.



Features:

- Underwriter's Lab. approved junction box
- Midget fuses inside junction box
- Guard, holder, and junction box have Plasti Sol-type coating
- Renewable heating elements
- Use with automatic temperature controls

*TRADEMARK

WRITE FOR OUR 4-PAGE BULLETIN TL-52 ..

Glo -QUARTZ ELECTRIC HEATERS CO., INC.
Mfgrs. of Fused Quartz Electrical Heating Elements
37934 ELM STREET • WILLOUGHBY, OHIO

High Quality
COPPER and BRONZE WIRE
High Carbon and Low Carbon
Specialty Steel Wire

Spencer wire corporation
555 LEHIGH AVENUE, UNION, N. J.
Plants at Union, N.J., Hillside, N.J., West Brookfield, Mass.

SCHUMAG

Continuous Bar and Rod Making Machines

Produce directly from the hot rolled or extruded coil material in a single, evenly continuous operation and with one operator, perfectly straight and highly polished bars and rods; round, square, hexagon and flat. Capacities 1/16 — 1 in.

Centerless Grinding and Polishing Machine

Grinds and polishes in one operation steel bars, drill rods, small shafting, etc.; highly polished and condensed surface, great accuracy and roundness, and very large output. Capacity up to 25/32 in. dia.

Write for complete information.

W. A. SCHUYLER

250 West 57th Street • New York 19, N. Y.

fine wire made finer

custom drawn
custom insulated
custom spooled . . .
to your most exacting requirements

◎ Specify the electrical properties, flexibility, tensile strength, laying speed, uniformity and other characteristics you must have. Our Hudson and Winsted Divisions will meet and maintain your specifications.

Yes, "Fine Wire Made Finer!" That's why Hudson-Winsted fine wires are the first choice of electrical, radio-TV and electronic manufacturers whose products are noted for reliability and long life.

◎ Tell us your wire problems and requirements. Our research, engineering and production facilities are at your disposal. Let us quote!

Hudco Winco hudson wire company

general offices: ossining, n. y. ◎ winsted division, winsted, conn.

Backed by twenty years' experience in molding corrosion-resistant equipment for chemical process industries, Haveg Corporation plans to market the standard line either through leading suppliers of heat exchange equipment or direct. Customers' designs can be adapted easily to molded Haveg construction with any type of tube bundle supplied.

★ ★ ★

Complete descriptive matter, including blueprints, may be obtained by writing Haveg Corporation, Marshallton, Del.

To Emphasize Automation in Metals Show

To back up its theme of "automation in the modern plant," the **Westinghouse Electric Corporation** exhibit at the National Metals Exposition will contain an unprecedented number of major new apparatus. Each new unit will be evaluated on the basis of its relation to in-line production in the metal-working plant.

★ ★ ★

Following are the products that will be shown for the first time: a new smaller, lighter, d-c rectifier arc welder—the result of four years of intensive development; a new gas-fired shaker hearth furnace with radiant tubes and a protective atmosphere—designed to handle small parts; a new x-ray productograph—for conveyor line x-ray operation in handling castings or fabricated parts; and a new 25-kw, rf generator for induction heating. Other displays include an x-ray fluoroscope, three magnetic amplifier demonstrators, and an automatic welding set-up.

★ ★ ★

The Westinghouse exhibit will be in booth No. 1611. **Amos Germain,** Steel Mill Section, Industrial Department, East Pittsburgh, will be the Westinghouse representative.

Heating Element Wire

The majority of electrical heating elements, such as those in ranges, toasters and irons, are made of nickel-chromium wire because it withstands heat so well and possesses electrical resistance to develop the heat.

The TOP DIAMOND DIES are made by PHILIPS

For your most exacting wire drawing requirements, standardize on NORELCO Diamond Dies, made by the master craftsmen of PHILIPS in the world's largest, most modern diamond die factory.

Only the very best South African and Brazilian diamonds are used. Each consists of one closed crystal. Less than .4% of all the diamonds mined meet PHILIPS high quality requirements for purity, structure and shape.

These diamonds are drilled to precision tolerances, varying in proportion to the diameter, normally 0.3 to 3.5 microns. Closer tolerances can be supplied, if required.

Let us quote on your diamond die requirements.

North American Philips Company, Inc.
100 East 42nd Street, New York 17, N. Y.

Norelco

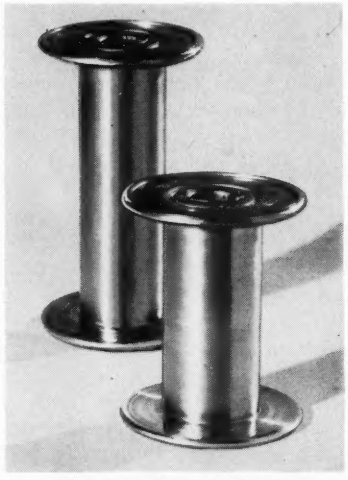
Note below the highly polished precision shaped drawing channel of this die for drawing copper which gives a burnished finish to the wire and long life to the die.

New Improved Braider Spool

A new and stronger Braider Spool of welded aluminum alloy—1/3 the weight of those currently in use—has been announced by **Acrometal Products, Inc.** of Minneapolis who collaborated with **Wardwell Braiding Machine Co.** of Central Falls, Rhode Island in the design of this improved spool for wire braiding.

★ ★ ★

It will be made immediately available for Wardwell Braiding Machines, for which it was especially designed, and combines



New Acropak Braider Spool

ACROPAK'S experience in the manufacture of precision spools with Wardwell's experience in the making of braiding machines. The announcement comes jointly from **Fred J. Bieber,** general manager of Acrometal and **K. F. Birchmeier,** Superintendent of Wardwell.

★ ★ ★

Several features of this new development will immediately interest all those employing braiding operations.

★ ★ ★

First: These new spools are stronger, and they provide a better spindle fit, greater concentricity and are only 1/3 the weight of old models.

Second: You can fill them to capacity without danger of distortion or breakage.

Third: The head is an integral part of the barrel. That means there are no cracks or separation between head and barrel and, therefore, no chance for wire entrapment.

FOR

EXTRA TONNAGE

FROM YOUR BAR STOCK AND WIRE DIES

COAT WITH BORAX 5 MOL.

Borax and Borax 5 Mol Offer Many Advantages as a Coating Material

Here is dust-free, granular material that is readily soluble in water and dries quickly. The residual film is tight yet pliable... won't flake off! Borax is safe to use, easy to handle, and non-irritating to the skin. You can feed stock faster and you get longer, more accurate performance from your dies.

Check these advantages of borax-coated stock:

- COMPATIBLE WITH DRAWING LUBRICANT
- BETTER WORKING CONDITIONS
- FASTER BUTT WELDING
- LONGER DIE LIFE
- LONGER STORAGE SAFETY
- CLEANER TO HANDLE IN TRANSIT

Write for Technical Data Sheet #2 WD

PACIFIC COAST BORAX CO.

DIVISION OF BORAX CONSOLIDATED, LIMITED

NEW YORK • CHICAGO
LOS ANGELES • CLEVELAND
PHILADELPHIA

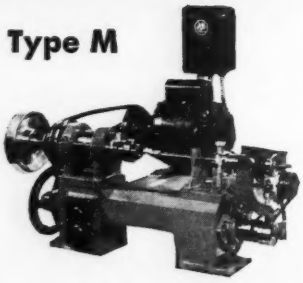
MANUFACTURERS OF FAMOUS "20 MULE TEAM" PACKAGE PRODUCTS

NEW

DYKREX

"IT CORRECTS THE DIE"

Type M



The Wire Die Finishing Machine that finishes and polishes with split-second changeover

SAVES 1/2 the Labor Cost

It's Automatic, too!

Made and Developed by
ROOS TOOL & MFG. DIVISION
DYKREX CORPORATION OF AMERICA
"The Standard of the Wire Industry"
33-35 BLOOMFIELD AVENUE
NEWARK 4, N. J.

Fourth: The edge of the flanges are burnished satin-smooth for easy wire take-off.

★ ★ ★

It is predicted that this new spool will improve efficiency, reduce wire breakage and increase hourly production. Two sizes will be produced initially: short traverse for 16 carrier braiders and long traverse for 24 carrier braiders. They will be available from both Acrometal Products, Inc., Minneapolis, Minn., and Wardwell Braiding Machine Co., Central Falls, Rhode Island.

Chicago Distributor Nearing Completion of Expansion

The Fullerton Steel & Wire Company is nearing completion of its $500,000 plant expansion at 6605 W. Fullerton Ave., Chicago.

★ ★ ★

The main span for steel storage is 80 feet wide and the non-ferrous department will have a 50 foot span. The added space will enable speedy selection of material for immediate shipment. The old main warehouse building will be converted into a service department which will house a battery of shears, slitters, and other new production equipment. Each bay is equipped with a new overhead crane running the entire 300 foot length of the addition. A railroad siding runs directly into the building enabling them to load or unload directly from freight cars.

★ ★ ★

One of the unique innovations is the automatic electric railroad with a ten-ton capacity running interdepartmentally to expedite the movement of metal from bay to bay.

A Complete Cable Accessories Catalog

A new cable accessories catalog has been published by **Anaconda Wire & Cable Co.** It is very complete.

★ ★ ★

The Cable Accessories Catalog, Publication No. C-79-13-14, is a combination of Sections 13 and 14 of Anaconda's General Catalog, Publication No. C-79. Section 13,

7 out of 9

WIRE MILLS
that Liquor Finish Wire

use M&T STANNOUS SULFATE *because*

Tin Losses Are Reduced . . .
by elimination of high tin sludging due to incomplete reaction in feather tin method.

Results Easier to Control . . .
only two variables to watch — Stannous Sulphate and Copper Sulphate — allows immediate, simple color adjustment.

Every Batch the Same . . .
M&T Stannous Sulphate method produces smooth, uniform wire coatings, unvarying from lot to lot.

See how use of M&T Stannous Sulphate can help you save tin in liquor finishing. Write for engineering data.

METAL & THERMIT CORPORATION
Chemical Division
100 E. 42nd St., New York 17, N. Y.
Specialists in Tin and Tin Chemicals

S. A. ETECO

ZWEVEGEM
(BELGIUM)

Selling Office for
Tréfileries León Bekaert,
S.P.R.L.

STEEL WIRES

ATTRACTIVELY PRICED

IF YOU REQUIRE

Submit your

SPECIFICATIONS

To The

REPRESENTATIVES:

J. GERBER & CO., INC.

855 Avenue of Americas
NEW YORK 1, N. Y.

"Potheads and Terminals," was previously issued and drew immediate attention from the industry. Section 14, "Accessories for Wire & Cable," is brand new and tells all about making joints. It includes drawings of 45 different joint designs.

★ ★ ★

Specifically, the Cable Accessories combined catalog includes:

All pertinent information on potheads, filling compounds, paints and allied items, with complete discussion of Anaconda pothead features, application and installation data, etc.

All about joints, connectors, rolling tools, drawbenches, tie wire, armor rods, accessories for ACSR and steel ground wire, and allied items.

As with all other sections of Anaconda's General Catalog, every effort has been made to keep information and data simple and direct. Moreover, finding one's way around in the book has been made easy through an index.

★ ★ ★

Copies of the new Cable Accessories Catalog, C-79-13-14, can be secured by writing direct, on company letterhead, to Fred Luna, Director of Sales Promotion, Anaconda Wire & Cable Co., 25 Broadway, New York 4, New York.

35th National Metal Exposition

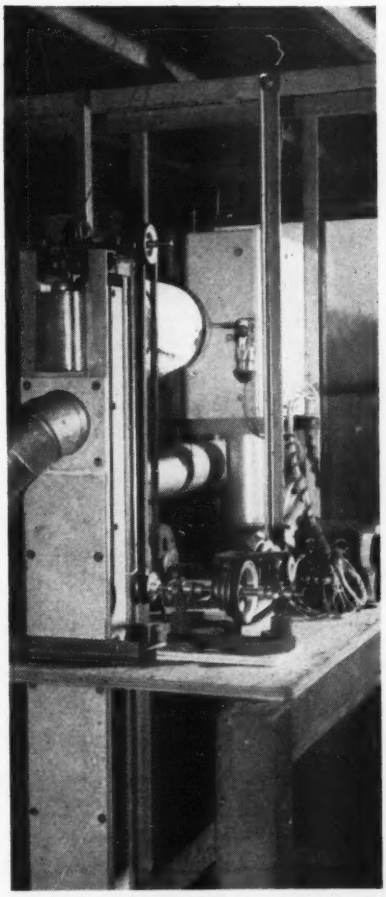
The American Brass Company will exhibit at the 35th National Metal Show, October 19th through the 23rd, in Cleveland. At Booth #141 the company will feature Formbrite Drawing Brass, a metal that is stronger, harder and springier than the usual drawing brasses, yet retains remarkable ductility for forming, drawing and embossing. Hundreds of end use items made of Formbrite, plain and plated, will be on display.

★ ★ ★

Other products to be shown will be Anaconda Welding Rods and an assortment of repair welded parts. Automatic projection of Kodachrome slides will show modern welding procedures with Anaconda Rods.

★ ★ ★

There will also be exhibit display boards of phosphor bronze, nickel silver, flexible metal hose, tubing, eyelets and other formed parts.



THIS LACQUER TOWER OPERATES LIKE YOURS!

It may not look like the equipment in your plant, yet this pilot lacquer tower duplicates your own lacquering operations.

It is used in the research laboratories of New England Lacquer to test thoroughly all formulated lacquers under actual on-the-job conditions. This and other modern research facilities enable us to formulate lacquers which satisfy your most rigid requirements.

Let our research facilities solve *your* lacquer problems. Write today!

The above photograph is one of many contained in an eight-page brochure describing our facilities to serve you. Write for your copy of the complete brochure!

NEW ENGLAND LACQUER CO.
150 KING PHILIP ROAD
EAST PROVIDENCE, R. I.

Booklet on Fatty Alcohols

A new booklet that tells how to use CACHALOT brand cetyl, oleyl, and stearyl alcohols in various applications is available to chemists, production managers, and purchasing agents.

★ ★ ★

Of particular interest to our readers is the use of these products in drawing oils. A copy may be secured by writing M. Michel & Co., 90 Broad St., New York 4, N. Y.

Nickel Silver

The ancient Chinese were the first to produce the alloy known today as nickel silver. They called this metal—a combination of nickel, copper and zinc—"paktong," which meant "white copper." The alloy was later referred to as German silver and finally as nickel silver.

★ ★ ★

Nickel-copper ores found in Saxony early in the 18th century originally were known as "Kupfer-Nickel," meaning "Old Nick's Copper." The superstitious miners gave it this name because the metal obtained could not be hammered into useful articles and they believed the devil or "Old Nick" had cast a spell over their ores. When from similar ores a previously undiscovered element was isolated by Cronstedt in 1751, he named it "nickel."

African Copper Flowing to U. S.

Last spring a freighter left Africa's east coast loaded with big slabs of copper addressed to "Phelps Dodge Corp., U.S.A."

★ ★ ★

It was the Africa's opening shot in a brewing battle for some of America's big market for the metal. In recent months, additional shipments of semi-refined Rhodesian copper have been flowing to other U. S. smelters; refined Belgian Congo copper has been moving directly to American consumers.

★ ★ ★

Dwindling demand among Africa's traditional European customers is causing producers here to eye the U. S. for the first time as a major outlet. Our producers are already confronted with weakening markets and slipping prices; in late July a leading American supplier cut its domestic copper price by three-quarters of a cent a pound to 29 cents, and a week later lowered it to 28½ cents, partly because of increased supplies from Africa.

★ ★ ★

Copper market competition from Africa promises to be keen. In the Copperbelt the ore is so rich and the labor so cheap that producers are said to be able to reduce prices 50% below the U. S. break-even point and still make money.

★ ★ ★

American copper is scattered all over the country. Most of it comes from such big western states as Arizona, Utah and Montana. But they also mine copper in Vermont, Tennessee and 22 other states of the Union.

★ ★ ★

SAMPLE
to your specifications furnished FREE
HEANIUM®
WIRE GUIDES
*Can be obtained thru
WARDWELL BRAIDING MACHINE CO.
Remember —Heanium Guides perform best under the most difficult conditions
HEANY INDUSTRIAL CERAMIC CORP., New Haven 3, Conn.

Now Available to the Wire and Cable Manufacturer

VELOCITY-OF-PROPAGATION METER

A small, sensitive instrument designed to measure the velocity of propagation in R-F cables to 2% accuracy. Quotations and further details on request.

Special Electronic Wire and Cable Test Equipment Built to Specifications.

MANSON LABORATORIES
207 Greenwich Avenue • Stamford, Conn.
Industrial Control Devices — Electronic and Electro-Mechanical Instruments

WIRE DRAWING MACHINERY
AND EQUIPMENT

FINE WIRE MACHINES • SPOOLERS • POINTERS
PATENTING, TEMPERING, GALVANIZING AND TINNING EQUIPMENT FOR WIRE

WRITE FOR PRICES

SUPERIOR TOOL & MANUFACTURING CO.
172 UNION STREET • WORCESTER, MASS.

METAL BOUND RETURNABLE REELS

Made in 12" to 24" diameters.

No nails used. *All glued construction.* Made of kiln-dried wood. Special design prevents breaking or splintering of wood, protecting insulated wire from damage.

Write for details

WILLIAM McCASKIE, INC.
FORGE ROAD • WESTPORT • MASS.
Tel.: 145 Est. 1903

Africa's copper is not only almost all in one place, but it's also rich. One of America's biggest mines, Kennecott Copper Corp.'s Utah Copper Mine, has ore that has less than 1% copper content on the average. "We wouldn't dream of fooling with trash like that," says one manager of a Belgian Congo mine whose average ore contains 11% copper.

★ ★ ★

There's enough to last for a long time. In the Congo it is estimated that there is 10 million tons of copper metal reserves in the more-than-6% class. After that's gone the Belgians will still have 4% ore, of which there's 30 million tons in terms of metal—more than 100 years' supply at today's operational level.

★ ★ ★

Northern Rhodesia has a measured reserve of 18 million tons of metal averaging 3.85%, but there's lots more unmeasured.

★ ★ ★

Sales of Rhodesian copper to American firms have been of blister copper. About 99.4% copper, blister must go through a further refining stage to reach the 99.9% pure state necessary for use in such products as electrical wire.

★ ★ ★

The U. S. consumes about half the world's copper output. Last year world consumption was 3,220,000 tons, of which the U. S. alone used 1,446,000 tons. To fill this demand, American copper consumers had to import 444,000 tons, mostly from Chilean mines owned by U. S. copper mining firms.

Packaged-Drive Booklet Available From Westinghouse

Packaged adjustable-voltage drives for variable speed applications are covered in a 16-page booklet available from the Westinghouse Electric Corporation. The first of its kind, this booklet gives complete information about this adjustable voltage drive: construction and operation, typical applications, and the economics of operation are discussed.

★ ★ ★

Special operational characteristics that can be added to the standard package—such as inching, reversing, dynamic braking and multi-motor control—are described, and case histories of these AV drives in the machine tool, textile, and continuous processing industries are cited.

★ ★ ★

For a copy of this booklet, B-5808, write Westinghouse Electric Corporation, Box 2099, Pittsburgh 30, Pennsylvania.

New Accident Annual

Occupational accidents in 1952 cost American industry $45 per worker, according to the National Safety Council's statistical annual, "Accident Facts." Just off the press, the 1953 edition points out that 15,000 persons were killed and 2,000,000 injured while at work in 1952. The total time lost as a result of occupational injuries reached the staggering total of 250,000,000 man-days.

★ ★ ★

In addition to the occupational section, detailed statistical infor-

(*Continued on page* 1147)

Top quality non-returnable spools . . . available in standard head and barrel sizes.

Write for a quotation today!

MASON CAN COMPANY
1949 Dexter Rd., East Providence 14, R. I.
MASON CAN COMPANY OF OHIO
Greenville, Ohio

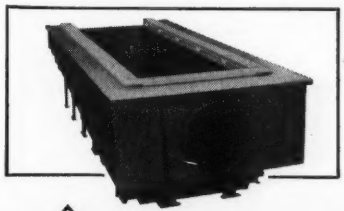
Long Life...free from Corrosion
HAVEG Pickling Tanks

There is no substitute for genuine Haveg tanks with their superior resistance to corrosion and permanent freedom from contamination.

HAVEG is a moldable, thermosetting plastic made of asbestos and resins selected for specific service with various corrosives. It is not a lining or coating . . . but is a solid corrosion-resistant material through and through.

As you increase the speed and output of pickling, the need for Haveg tanks, perforated pipe, pumps, pipe and valves increases. Act now.

Write for 64-page Bulletin F-6 with tank sizes, method of construction, chemical ratings.



HAVEG CORPORATION
NEWARK 47, DELAWARE

HANS BOEHL, MACHINE WORKS,
Hueckeswagen/Rhld., Germany

—•—

EQUIPMENT
for
WIRE FORMING
WIRE COILING
(Spring Winding)
WIRE WRAPPING

—•—

LENDT & COMPANY, INC.
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Tel: VAnderbilt 6-5671

BETTER!
OUR EXCLUSIVE PROCESS
for
DIAMOND POWDER RECLAMATION

Will recover for you a higher percentage from used diamond powders, wheels, etc.
Your old cotton, die washings, worn wheels, sludge, etc., have great value.
With our process you can be assured of
MAXIMUM RECOVERY

Send us your waste diamond materials

We are also now supplying a complete line of top-quality
DIAMOND GRINDING WHEELS
Write for prices

NATIONAL RESEARCH COMPANY
25530 Little Mack Ave.
St. Claire Shores, Mich.

Twisted Paper's Role in the Wire Industry

(*Continued from page* 1061)

(Fig. No. 4.) The excellent abrasion and compression resistant qualities of twisted paper is gain-

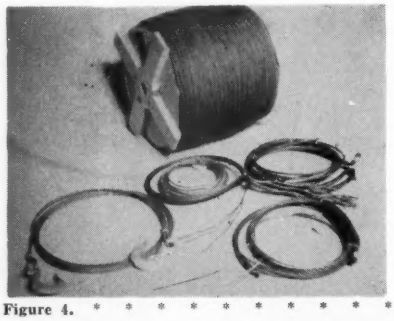

Figure 4. * * * * * * * * * *

ing recognition. Produced in endless length packages, weighing as much as 100 pounds each, of uniform diameter, paper offers equal fatigue life of hard fibres, even when of lesser tensile strength. Samples of paper cores in one-ply and multiple strand constructions, with various treatments, have been submitted to the Wire Rope Engineering Committee for field evaluation. There have been no reported breakdowns or failures in the field after six years of commercial use.

★ ★ ★

Chart #3 illustrates comparative fatigue life of paper versus hard fibres as reported to us by two wire rope manufacturers.

★ ★ ★

The necessity of having an improved domestic alternate for peace time and emergency use is unquestionably desirable. The Wire Rope Engineering Committee approval of paper core, if granted, will pave the way for Government use.

★ ★ ★

As increasingly larger volume of paper yarn and cordage is used in the electrical and wire rope industries its many advantages will gain in appreciation and new applications will develop. The introduction of paper cordage into the electrical industry has been influential in stabilizing the market prices of imported coarse fibers.

★ ★ ★

YARNS

For electric wire. Acetate, nylon and silk, natural or dyed. Put up on braider tubes, spools or cops.

OSCAR HEINEMAN CORPORATION

Division of Aetna Industrial Corp.

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President and General Manager
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Concord Branch
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Sales Agents
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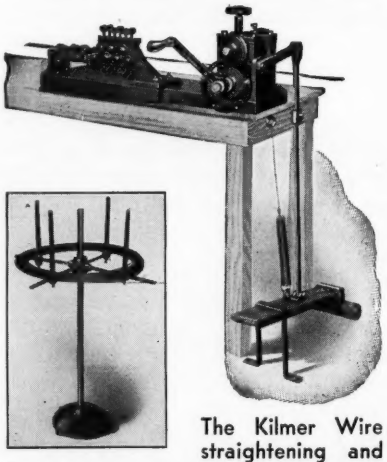
1001 Provident Bldg., Chattanooga
Tel. 7-8879

THOMAS C. ASSHETON CO.
11 West 42nd St., New York 18, N. Y.
Tel. PE 6-8280

FRANK LUNDAY
P. O. Box 1154, Charlotte, N. C.
Tel. Charlotte 8100

WIRE STRAIGHTENER



The Kilmer Wire straightening and cutting machine is hand operated and recommended for wire No. 8 to No. 19 gauge.
Wire Reel will handle coils up to 150 lbs. with I.D. adjustments from 7" to 22" and 30" O.D.

M. D. KILMER & COMPANY
4840 BROOKPARK RD.
CLEVELAND 9, OHIO

Warner

BELL-MINE
LIME
for
WIRE DRAWING

WARNER COMPANY
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FOR TOUGH, STRONG
PLYWOOD
REELS & SPOOLS
FOR WIRE, ROPE and PLASTICS
use those made by the largest plywood reel manufacturer in America.
Get our prices today.

CHARLES lavendier
CO., INC.
P. O. Box 402 Pawtucket, R. I.
Telephone: PA 2-1300

Paper converters are adopting modern methods of quality control and developing specially designed packages of endless lengths for specific machine requirements. Where a uniform, low cost, bulk factor is required, and within reasonable limits, paper in most cases can replace soft and hard fibers. When engineered properly, it will result not only in lower raw material costs, but also in higher manufacturing efficiencies.

★ ★ ★

With "plastic-like" uniformity and aided by the multitude of chemical additives being developed, the actual potentialities of twisted paper products are unpredictable and unlimited.

Norton To Exhibit at Metal Show

Norton Company of Worcester, Mass., will exhibit both abrasive and refractory products in its display booth No. 1933 at the National Metal Exposition to be held in Cleveland, October 19 to 23.

★ ★ ★

To be introduced publicly for the first time at this show will be Norton CRYSTOLON Heating Elements. These elements, now being introduced commercially, have been used successfully for several years in Norton's new plant for the production of precision grinding wheels. These electrically fired tunnel kilns require a minimum of maintenance and element life is up to 18 months. Complete technical information on these elements will be available at the show.

★ ★ ★

Cut-off wheels will also be featured. To demonstrate the use of tumbling abrasive for barrel finishing, Norton will display a transparent plastic tumbling barrel which will show the action within the barrel when parts are finished by this method. An actual ESBEC Bench Type finishing barrel will also be on display and rough parts will be finished.

★ ★ ★

Refractory products for use in metal melting and heat treating furnaces will also be shown. Other refractory and abrasive products will make up the balance of the Norton display.

SMALL WOOD SPOOLS
for
WIRE
Range of Sizes:
1" long with ¾" head diam.
up to
3½" long with 2⅛" head diam.

Supplied stained in any color according to your needs.
Special finishes to order.

"NOWASCO" WOOD SPOOLS are used by many wire manufacturers for wire prepared for retail sale.

Write for samples and prices.

NORTH WATERFORD SPOOL CO.
P.O. Box W
North Waterford, Maine
Tel.: Harrison 96-2
1918-1953

HKP
PORTER
HANDKLIP
6C WIRE
CUTTER

For FREE CUTTING of wires, cable, rods, baling wire and bolts up to medium hardness.

One of the handiest, most useful cutters ever made. Parrot-beak jaw quickly locates material for easy cutting. Protruding tip of jaw prevents wire from slipping, aids in stretching wire and is great for pulling out staples.

Essential equipment for cutting high tensile communication and power wires used in rural electrification (Model 6B with special hard cutting edges). See your supplier.

H. K. PORTER, INC.
Somerville 43, Mass.
Porter Cutters Porter Pruners
PORTER-FERGUSON Autobody and Fender Repair Tools

Specializing in

WIRE CLOTH WEAVING

• • • For every metal
Up to the finest mesh in bronze and stainless steel.

Write for details

GANTOIS

MA CORNE S. V. BRISE

SAINT-DIE (VOSGES) FRANCE

THE MAN who is "YOUR WIRE SUPPLIER"

WIRE STRAIGHTENED AND CUT TO LENGTH

From 18 gauge through 5/8" diam.
WE WILL FURNISH THE WIRE or STRAIGHTEN and CUT YOUR STOCK.
"Straight as an Arrow"
Telephone: ERIE 4-7139

ERIE IRON & SUPPLY CORPORATION
1059 EAST BUFFALO ROAD, ERIE, PENNA.

THE BETTER YOUR WIRE . . .
THE BETTER YOUR PRODUCT!

Choose *Cortland* GALVANIZED WIRE

Fine products are made from fine-quality materials. That's why so many fabricators and formers select Cortland Brand specialized low carbon wires. Cortland Brand wires are among the finest available . . . made from the best corrosion-resisting, open-hearth steel in Wickwire's own mills. Use them for your products . . . in any of the following types, sizes and finishes.

Cortland Brand

SIZE: coils, spools or straightened cut to length.
FINISH: plain, galvanized, coppered or tinned.
TYPE: stone wire, bookbinder, flat, etc.

WICKWIRE BROTHERS, INC. **CORTLAND, N.Y.**

WE BUY WE SELL

We Pay Highest Prices for Used Machinery

WANTED
your idle and surplus
EQUIPMENT

Send Your List for Prompt Selection
All Machines Reconditioned in Our Own Shop

WIRE & TEXTILE MACHINERY INC.
P. O. BOX 436, PAWTUCKET, R. I.

Neoprene Coverings for Weatherproof Wire

(*Continued from page* 1049)

tee's painstaking investigation, involving many conferences with producers and consumers, has resulted in a suggested specification which will undoubtedly become the standard for the industry. Those requirements of the suggested specification which pertain to the neoprene covering are shown in Table II. For comparison purposes, the widely used neoprene jacket specification ASTM D 752 is also included in this table.

★ ★ ★

Some idea of the physical and electrical properties of commercially produced neoprene covered line wire is given in Table I. The values shown in this table were obtained on coils of wire purchased from five manufacturers in 1950. The degree of difference in the physical properties of the coverings probably reflects the absence of any type of specification at the time of their manufacture. The fact that all of these coverings exceed the minimum requirements of the suggested ASA specification, however, reflects credit on the wire and cable manufacturers and also on their important customers for intelligently appraising the requirements. Numerous laboratory tests have been made on these wires in addition to outdoor tests still in progress. The results of the tests show that neoprene coverings stand up very well both in physical and electrical properties and can be depended upon to give many years of trouble-free service.

Wire Association papers received too late for publishing in this issue will be published in the November and December issues of WIRE AND WIRE PRODUCTS.

The Drawing of Shaped Steel Wire

(*Continued from page* 1046)

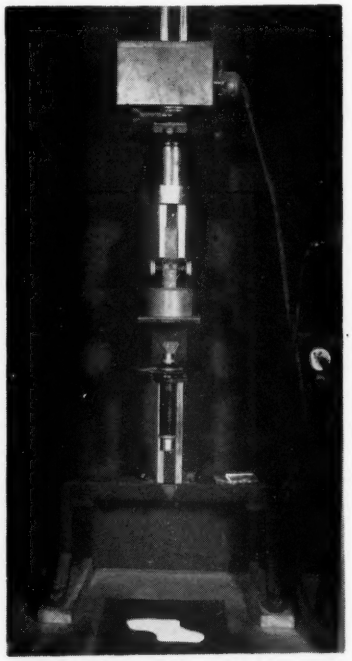

Figure 7.

Figure 8.

★ ★ ★

In closing the writer wishes to express gratitude to the personnel of the Roebling Shaped Die Shop, Mr. Leonard Oblinger and the late Mr. Zigmund Musinski, whose skill and knowledge helped bring this work to successful completion.

REELS SPOOLS

ALL SIZES

WOOD - PLYWOOD - WOOD - METAL

RETURNABLE NON-RETURNABLE

Samples and Prices on Request

DURKEE MFG. CO. PINE RIVER, MINN.

15,000,000 FEET OF WIRE FROM "BRIDGEPORT" CARBIDE NOZZLES!

These are made for use in extruding machines in covering electric wire with rubber or plastics.

Carbide nozzles are giving 300 times the production secured from those made of tool steels.

Precision-made carbide tools, any type, made to your order.

WIRE TOOL DIV., BRIDGEPORT JIG BORING COMPANY

303 STRATFORD AVE. • BRIDGEPORT, CONN.

• REELS •

RETURNABLE - PLYWOOD - NON-RETURNABLE

Manufactured to Your Particular Requirements

Prompt Shipments on Large or Small Orders

Specialists in the design and manufacture of all types of PLYWOOD REELS and SPOOLS

CARRIS REELS, INC.

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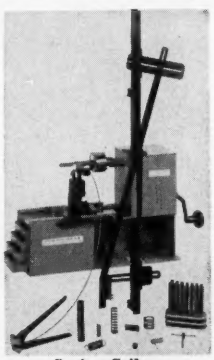

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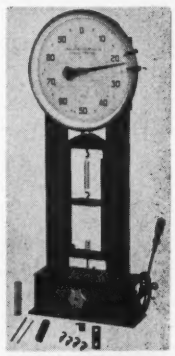

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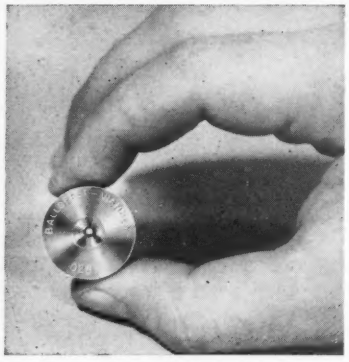

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The Foreman's Function Regarding Methods

(*Continued from page* 1038)

We have just discussed the impact of the human element and the causes assignable to mechanical reasons. It is true that variation between pieces may be very slight, but it is still there.

★ ★ ★

Thus we see that there are two forces pulling in opposite directions. The trick is to keep variation within the limits that the customer calls an acceptable tolerance.

★ ★ ★

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Wire Association Convention Papers received too late for publishing in this issue will be published in the November and December, 1953 issues of WIRE AND WIRE PRODUCTS.

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(*Continued from page* 1141)
mation is provided on accidents of all types—motor vehicle, transportation, home, farm and school. Single copies of the book may be obtained from the National Safety Council, 425 North Michigan Ave., Chicago 11, Ill., at 75 cents each. Prices are reduced for quantities.

Booklet on Re-Wiring

Full Power Ahead, 16-page brochure, is a complete promotional kit, Anaconda Wire and Cable Company's contribution to the electrical industry's counterattack on obsolescent wiring. The program has been worked up to benefit electrical contractors, electrical distributors and utilities "to promote and provide for extended use of electricity on the farm, in the home, in small industry, and in commercial enterprises."

★ ★ ★

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Pages of the brochure itself show the way each group can organize cooperatively, including information on how to finance wiring modernization work by property improvement loans insured under "Title I" of the National Housing Act, together with direct mail and letterhead samples for use by the utilities, etc.

New Booklet Illustrates Uses of Versatile Beryllium Copper

Ways in which beryllium copper can help engineers solve their design problems are illustrated by actual uses in a new booklet, "Applications Unlimited," offered by The Beryllium Corporation, Reading, Pa. A pioneer in the development of this unusual metal, The Beryllium Corporation maintains the most highly integrated facilities in the industry and is the world's leading producer of materials incorporating the element beryllium.

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Copies of "Applications Unlimited" are available without cost from The Beryllium Corporation, Reading, Pa.

Publishes New Bulletin On Steel Shot Abrasive

A new bulletin describing Wheelabrator Steel Shot, a new blast cleaning and peening abrasive, has been published by American Wheelabrator & Equipment Corp., 1184 S. Byrkit St., Mishawaka, Indiana.

★ ★ ★

Of particular interest in this 8-page illustrated booklet is the discussion of the automatic process and quality control exercised in the company's brand new manufacturing plant. The plant is the largest of its kind in the world and is completely mechanized. Electric melting furnaces and automatically controlled heat treating equipment assure constant uniformity of product.

★ ★ ★

Other sections of the booklet include a discussion of the factors important to the economical and efficient consumption of steel shot abrasive, a photographic comparison of the useful lives of different abrasives, and a discussion on how to perform abrasive tests under actual operating conditions.

★ ★ ★

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★ ★ ★

The tables include series for O.E.E.C. Member countries, their Overseas Territories, the United States and Canada, both of which are associated in the work of the Organization. They also include figures relating to the other major producing countries, as well as to the world production. Furthermore, it has been possible in some tables to include a column for U.S.S.R. production. This enables European production to be seen against the world background.

★ ★ ★

Sources are given in detail in the O.E.E.C. publication "Definitions and Methods." Among those used are the existing international yearbooks, in particular the statistical yearbooks of the League of Nations (for data prior to 1928) and the yearbooks issued by the United Nations.

★ ★ ★

Data in any individual table have, as far as coverage is concerned, a reasonable degree of comparability. Footnotes indicate series where significant differences occur. Details on coverage, sources etc., for the various series are given in "Definitions and Methods: Industrial Production," O.E.E.C., 1953.

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★ ★ ★

The R-16 die was delivered by the Carboloy Department of G. E. in March, 1951, and it remained in use until May of this year—a total of 26 months service—when a crack developed. The finished size at delivery was 2.4315, in a six inch tapered case. When taken out of service, the size was 2.434, an increase of only .0025.

★ ★ ★

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★ ★ ★

During its life, the die was never polished. According to officials at Wyckoff Steel Company's New England Works this far exceeds the life of other similar dies and is thought to be a record for this type of operation.

★ ★ ★

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North Anson Reel Co. ..... 1071, 1082 and 1092
North Waterford Spool Co. 1143
Norton Co. 1132
Nukem Products Corp. 1149

P

Pacific Coast Borax Company 1137
Parkin Chemical Co., The ..... 1104 and 1105
Pittsburgh Carbide Die Co. 1148
Pittsburgh Steel Company 976
Platt Brothers & Co., The 1149
Porter, H. K., Co. 1143
Pourtier Freres, Ets. 1120

R

Rayaloy Carbide Corp. 1148
Reilly-Whiteman-Walton Company 1122
Republic Steel Corp., Pressed Steel Div. 978
Rockwell Co., W. S. 1132
Robinson Manufacturing Company 1113
Roebling's, John A. Sons, Corp. ..... 996A and 1092A
Root, B. M., Company 1110
Royle, John & Sons 974
Roux Wire Die Works, Inc. 963
Rusch Wire Die Corporation 1148

S

Scott Testers, Inc. 1133
Schuyler, W. A. 1136
Scudder, E. J. Foundry & Machine Co., Inc. 1149
Seneca Wire & Mfg. Company 1088
Sjogren Tool and Machine Co., Inc. 979
Sleeper & Hartley, Inc. 1149
Solar Compounds Corporation 1085
Spencer Wire Corp. 1135
Standard Electronic Research Corp. 1001
Standard Industrial Compounds Co., Inc. 1007
Standard Mill Supply Co. 1109
Standard-Toch Chemicals, Inc. 982
Steel Equipment Co. 1122
Superior Tool & Mfg. Co. 1040
Surface Combustion Corp. 1009
Swift & Company 996
Syncro Machine Company ..... 1044 and 1045

T

Techema Co., The 1148
Terkelsen Machine Co. 1148
Torrington Manufacturing Co. 1095
Trauwood Engineering Co., The 1013
Twitchell, E. W., Inc. 973

U

U. S. Steel Corp.—American Steel & Wire Div. 1014
Union Wire Die Company 1097
Universal Wire Die Co. 1147

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Vascoloy-Ramet Corporation 1016
Vaughn Machinery Company ... Front Cover and 1060 A, B, C and D

W

Wafios Maschinenfabrik 1006
Wardwell Braiding Machine Co. 1083
Warner Company 1143
Waterbury Farrel Foundry & Machine Co. ..... 952 and 980D
Watson Machine Company ..... Inside Back Cover
Wayne Wire Die Co. 1147
Wean Equipment Corporation ..... Inside Front Cover
Wells, Frank L. Co. 1106
Westinghouse Electric Corporation, Industrial Heating Dept. ..... 988 and 989
Wickwire Brothers, Inc. 1144
Willey's Carbide Tool Co. 1111
Wilson, Lee Engineering Co., Inc. ..... 980 B and C
Winchester Reel Co., Inc. 1133
Wire Insulating Mach'y, Inc., Div. of Machinery Electrical, Inc. 1117
Wire & Textile Machinery, Inc. 1144
Wire Tool Div., Bridgeport Jig Boring Co. 1145

Y

Youngstown Sheet & Tube Company, The 959
Youngstown Welding and Engineering Company 999

WHERE TO BUY

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.
Only advertisers who have contracted for six or more insertions are listed in this section.

ABRASIVES—
Elgin National Watch Co., Abrasive Div., Elgin, Ill.
Norton Co., Worcester, Mass.

ACID INHIBITORS—
(See Inhibitors, Pickling)

ACID-PROOF CONSTRUCTION—
Ceilcote Company, Cleveland, Ohio
Chemical Construction Co., Pittsburgh, Pa.
Haveg Corporation, Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio
Nukem Products Corporation, Buffalo, N. Y.

ANNEALING MACHINES — Electric Resistance
Syncro Machine Co., Perth Amboy, N. J.
Trauwood Engr. Co., Cleveland, O.

ANNEALING POTS AND BOXES—
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

BAKERS—(See OVENS—Rod Bakers)

BOBBINS—Braider & Wire Weaving
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Wire & Textile Mach'y, Inc (used) Pawtucket. R. I.

BORAX—Wire Drawing
Pacific Coast Borax Co., New York, N. Y.

BORON CARBIDE—
Norton Co., Worcester, Mass.

BRAKES—Pneumatic
Entwistle, Jas. L. Co., Prcvidence, R. I.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket. R. I.

CARTONS—Paper
(See CONTAINERS—Paper, for nails, etc.)

CASTINGS—Wire Mill
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

CEMENTS—Acid Proof
Ceilcote Company, Cleveland, Ohio

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CLEANERS—Metal
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Metal & Thermit Corp., New York, N. Y.
Parkin Chemical Co., The, Pittsburgh, Pa.
Standard Industrial Compounds Co., Chicago.

CLEANING & PICKLING EQUIP.—
Ceilcote Company, Cleveland, Ohio
Chemsteel Construction Co., Pittsburgh, Pa.
Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, O.
Haveg Corporation, Newark, Del.
Holden, A. F., Company, The, Detroit, Mich.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio
Youngstown Welding & Eng'g' Co., Youngstown, Ohio

CLOTH—WIRE, All Metals
Chase Brass & Copper Co., Waterbury, Conn.
Gautois, Saint Die (Vosges), France.
Roebling's, John A. Sons Corp., Trenton, N. J.
Wickwire Bros., Cortland, N. Y.

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Standard Industrial Compounds Co., Chicago.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.
Miller, R. H. Co., Inc., Homer, N. Y.
Techema Co., Buffalo, N. Y.

COMPOUNDS—Diamond (Pre-Mixed)
Eastern Carbide Corp., New Rochelle, N. Y.
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago.

COMPOUNDS—Extrusion, for Wire
(See Compounds—Vinyl)

COMPOUNDS—For Improving Drawing and Extrusion
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Metal & Thermit Corp., New York, N. Y.

COMPOUNDS—Phosphate Coating
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
American Lanolin Corporation, Lawrence, Mass.
Apex Alkali Products Co., Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago.

COMPOUNDS—Vinyl, for Wire
Electronic Rubber Co., Stamford, Conn.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Miller, R. H. Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Pacific Coast Borax Co., New York, N. Y.
Standard Industrial Compounds Co., Chicago.
Swift & Company, Chicago, Ill.

CONDUCTORS—Flexible, Electrical
Montgomery Co., The, Windsor Locks, Conn.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire & Textile Mach'y, Inc. (used) Pawtucket. R. I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

CORROSION PREVENTIVE PAPERS—
Angier Corporation, The, Framingham, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

CUTTING TOOLS—Wire
Porter, H. K. Inc., Somerville, Mass.

DIAMONDS—Industrial
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
Danforth, The C. W. Co., Youngstown, Ohio
Elgin National Watch Co., Abrasive Div., Elgin. Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Industrial Diamond Powders, New Kensington, Pa.
National Research Company, St. Clair Shores, Mich.
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDER RECLAIMING—
Boulin, Victor J., Inc., New York, N. Y.
Danforth, The C. W. Co., Youngstown, Ohio
Industrial Diamond Powders, Inc., New Kensington, Pa.
National Research Co., St. Clair Shores, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIAMOND TOOLS—
Carboloy Dept. of General Electric Co., Detroit.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation. Youngstown, Ohio
Nord International Corp., Denville, N. J.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Carbide, Tungsten & Tantalum
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rayaloy Carbide Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Wayne Wire Die Co., Hillside, N. J.

DIES—Cold Heading
Carboloy Dept. of General Electric Co., Detroit
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Rayaloy Carbide Corp., New York, N. Y.
Vascoloy-Ramet Corp., No. Chicago, Ill.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
North American Philips Co., Inc., Elmet Div., Lewiston, Me.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Extrusion
Carboloy Dept. of General Electric Co., Detroit.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Rayaloy Carbide Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Eyelet
Eastern Carbide Corp., New Rochelle, N. Y.
Kelly Wire Die Corp., New York, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Pittsburgh Carbide Die Co., Monongahela, Pa.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc, New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit.
Cochaud Wire Die Corp., New York, N. Y.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Ft. Wayne Wire Die., Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
New England Wire Die Co., Worcester, Mass.
North American Philips Co., Inc., Elmet Div., Lewiston, Me.
Rayaloy Carbide Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Wayne Wire Die Co., Hillside, N. J.

DIES—Special Shapes, Etc.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Murex, Ltd., Rainham, England
Rayaloy Carbide Corp., New York, N. Y.

DIES—Swaging
Murex, Ltd., Rainham, England
Rayaloy Carbide Corp., New York
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Dept. of General Electric Co., Detroit.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Murex, Ltd., Rainham, England
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRUMS & TRAVERSES—Flange Steel
Entwistle, Jas. L. Co., Providence, R. I.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

DRYING EQUIPMENT
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio.
Rockwell, W. S. Co., Fairfield, Conn.

ENGINEERS—Consulting
Metal Fatigue—Fatigue of Materials Laboratory, Princeton, N. J.
Wire Insulating and Rubber and Plastics Processing—Hale and Kullgren, Inc., Akron, Ohio
Zinc—Imhoff, Wallace G., Co., No. Highlands, Calif.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FENCING & FENCES—Wire
Interlocking Fence Co., Morton, Ill.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio
Harper Electric Furnace Corp., Buffalo, N. Y.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

Rockwell, W. S. Co., Fairfield, Conn.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

FURNACES—Galvanizing Equipment
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Holden, A. F. Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Trauwood Engineering Co., The, Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., The, Detroit, Mich.
Morrison Industries, Cleveland, Ohio
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Trauwood Engr. Co., Cleveland, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

FURNACES—Pot (oil, gas, electric)
Ajax Electric Co., Inc., Philadelphia, Pa.
Holden, A. F., Co., The, Detroit, Mich.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

FURNACES—Resistance Heating, Strand
(See Annealing Machines)

FURNACES—Salt Bath
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

GALVANIZING EQUIPMENT — (See MACHINERY—Galvanizing Wire)

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

GUIDES—for Wire
Heany Industrial Ceramic Corp., New Haven, Conn.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

HAMMERS—Nail Heading
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HOOKS—Pickling & Liming
Youngstown Welding & Eng'g' Co., Youngstown, Ohio

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

IMPREGNATING MATERIALS—
Solar Compounds Corporation, Linden, N. J.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INSULATING MATERIALS—
Belding Heminway, New York, N. Y.
Celanese Corporation of America, New York, N. Y.
Electronic Rubber Co., Stamford, Conn.
Glass Fibers, Inc., Toledo, Ohio
Heineman Corp., Oscar, Chicago, Ill.
Merrimac Paper Co., New York, N. Y.
Naugatuck Chemical Division of United States Rubber, Naugatuck, Conn.
New England Lacquer Co., E. Providence, R. I.
Solar Compounds Corporation, Linden, N. J.
Solar Varnish Corp., Linden, N. J.

INSULATING MATERIALS — Paper—For Electric Wire Cable
Merrimac Paper Co., New York, N. Y.
Solar Compounds Corporation, Linden, N. J.
Solar Varnish Corp., Linden, N. J.

LACQUERING SYSTEMS — See MACH.—Lacquering Electric Wire

LACQUERS—For Electric Wire
New England Lacquer Co., E. Providence, R. I.
Solar Compounds Corporation, Linden, N. J.

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LIME—
Warner Co., Philadelphia and Bellefonte, Pa.

LUBRICANTS — For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Standard Industrial Compounds Co., Chicago.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

LUMBER—Wire Mill, Carload shipments for lagging and car blocking
Canada Reels, Ltd., Bury, Que., Canada
North Anson Reel Co., No. Anson, Me.

MACHINERY—Armoring (Cable, Wire, Hose)
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Barbed Wire
Glader Machine Works, Chicago, Ill.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany
Wean Engineering Co., Cleveland, Ohio

MACHINERY—Bolts & Rivets
Meyer, Roth & Pastor Maschinenfabrik (Cosa Corporation, New York, N. Y.), Koln-Raderberg, Germany

MACHINERY—Braiding
Fidelity Machine Co., Inc., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Wardwell Braiding Mach. Co., Central Falls, R.I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bunching
Cook Manufacturing Co., The, Paterson, N. J.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Inc., Philadelphia, Pa.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Machinery—Winding Wire)

MACHINERY—Chain Making
Meyer, Roth & Pastor Maschinenfabrik (Cosa Corporation, New York, N. Y.), Koln-Raderberg, Germany
Nilson, A. H. Machine Co., Bridgeport, Conn.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Closing Rope
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Vaughn Mach'y Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Cold Heading
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Copper Wire Drawing
Aetna-Standard Engineering Co., Pittsburgh.
American Insulating Mach'y Co., Phila., Pa.
Hale and Kullgren, Inc., Akron, Ohio
National Mach'y Exch. (Used), New York.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)

MACHINERY—Cutting
Eisler Engineering Co., Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn.
Porter, H. K., Inc., Somerville, Mass.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Descaling Rod, Dry
Fisher Associates, New York, N. Y.

MACHINERY—Diameter Testing Continuous
Standard Electronic Research Corp., New York, N. Y.

MACHINERY—Die Making
American Optical Co., Instrument Div., Buffalo, N. Y.
Boulin, Victor J., Inc., New York, N. Y.
Carboloy Dept. General Electric Co., Detroit, Mich.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Firth Sterling, Inc., Pittsburgh, Pa.
Kelly Wire Die Corp., New York, N. Y.
Nord International Corp., Denville, N. J.
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Dry Blending Plastics
Robinson Manufacturing Co., New York, N. Y.

MACHINERY—Edging (See MACHINERY — Tandem Rolling and Edging Mills)

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, Ohio

MACHINERY—Extruding
Aetna-Standard Engineering Co., Pittsburgh.
Davis-Standard Sales Corp., Mystic, Conn.
Hale and Kullgren, Inc., Akron, Ohio
National Rubber Machinery Co., Akron, Ohio
Royle, John, & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Interlocking Fence Co., Morton, Ill.
Malmedie Maschinenfabrik, Dusseldorf, Germany
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark, N. J.

MACHINERY—Flat Wire
Mettler Machine Tool, Inc., New Haven, Conn.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp. Cleveland, Ohio

MACHINERY—Forming Wire
Baird Machine Co., Stratford, Conn.
Lendt & Co., Inc., New York, N. Y.
Nilson, A. H., Machine Co., Bridgeport, Conn.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle, Jas. L. Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating Wire
Aetna-Standard Engineering Co., Pittsburgh, Pa.
American Insulating Mach'y Co., Phila., Pa.
Davis-Standard Sales Corp., Mystic, Conn.
Ets. Pourtier Frères, Romainville, France
Fidelity Machine Co., Inc., Philadelphia, Pa.
Hale and Kullgren, Inc., Akron, Ohio
National Rubber Machinery Co., Akron, Ohio
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Mach. Co., Central Falls, R.I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Inc., Philadelphia, Pa.

MACHINERY—Lacquering Electric Wire
American Insulating Mach'y Co., Philadelphia.
Industrial Ovens, Inc., Cleveland, O.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Looms, Wire Weaving
Interlocking Fence Co., Morton, Ill.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Davis Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, Jas. L. Co., Providence, R. I.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Baird Machine Co., The, Stratford, Conn.
Glader, Wm., Machine Works, Chicago, Ill.
Meyer, Roth & Pastor Maschinenfabrik (Cosa Corporation, New York, N. Y.), Koln-Raderberg, Germany
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Optical, for Dies
American Optical Co., Instrument Div., Buffalo, N. Y.

MACHINERY—Pickling
Chemsteel Construction Co., Pittsburgh, Pa.
Youngstown Welding & Eng'g. Co., Youngstown, Ohio

MACHINERY—Pin Making
Baird Machine Co., The, Stratford, Conn.

MACHINERY—Pointing
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Hale and Kullgren, Inc., Akron, Ohio
Meyer, Roth & Pastor Maschinenfabrik (Cosa Corporation, New York, N. Y.), Koln-Raderberg, Germany
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Poultry Wire Fencing
Interlocking Fence Co., Morton, Ill.
Malmedie Maschinenfabrik, Dusseldorf, Germany
Wean Equipment Corp., Cleveland, O.

MACHINERY—Pre-Heater for Wire (for Extrusion of Plastics)
Industrial Ovens, Inc., Cleveland, Ohio
National Rubber Machinery Co., Akron, Ohio

MACHINERY—Re-Spoolers
Boyd & Sons Manufacturing Corp., Philadelphia, Pa.
Davis Electric Co., Wallingford, Conn.
Eisler Engineering Co., Newark, N. J.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Providence, R. I.
National Mach'y Exch. (Used), New York, N. Y.
Steel Equipment Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

MACHINERY—Rod Mill
Morgan Construction Co., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Engineering Co., Cleveland, Ohio

MACHINERY—Rubber Insulating
Davis-Standard Sales Corp., Mystic, Conn.
National Rubber Machinery Co., Akron, Ohio
Royle, John & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Spark Testing
Davis Electric Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Providence, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Spring Making
Carlson Company, The, New York, N. Y.
Lendt & Co., Inc., New York, N. Y.
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany.

MACHINERY—Straightening & Cutting
Kilmer, M. D., & Co., Cleveland, Ohio
Lewis Machine Co., The, Cleveland, Ohio
Medart Co., The, St. Louis, Mo.
Mettler Machine Tool Co., New Haven, Conn.
Meyer, Roth & Pastor Maschinenfabrik (Cosa Corporation, New York, N. Y.), Koln-Raderberg, Germany
National Mach'y Exch. (Used), New York, N. Y.
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Stranding
Haskell-Dawes Machine Co., Philadelphia, Pa.
Hughesville Machine & Tool Co., Hughesville, Pa.
Maillefer S. A., Renens-Lausanne, Switzerland.
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Robinson Manufacturing Co., New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Take-Up and Pay-Out
Aetna-Standard Engineering Co., Pittsburgh, Pa.
American Insulating Mach'y Co., Phila., Pa.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Sales Corp., Mystic, Conn.
Hale & Kullgren, Inc., Akron, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Marshall-Richards Machine Co., Ltd., Crook, County Durham, England
Robinson Manufacturing Co., New York, N. Y.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Ets. Pourtier Frères, Romainville, France
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Testing, Physical
Scott Testers, Inc., Providence, R. I.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Steel Equipment Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill, Cold Drawing
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Hale & Kullgren, Inc., Akron, Ohio
Marshall-Richards Machine Co., Ltd., Crook, County Durham, England
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N. J.
Davis Electric Co., Wallingford, Conn.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.

MACHINERY—for Wire Welding (See WELDERS—Butt and Spot)

MACHINERY—Winding Wire
Eisler Engineering Co., Newark, N. J.
Entwistle, Jas. L., Co., Providence, R. I.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark, N. J.
Kilmer, M. D., & Co., Cleveland, Ohio

MACHINERY—Wire Drawing
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Hale & Kullgren, Inc., Akron, Ohio
Herborn, Herborn, Germany
Marshall-Richards Machine Co., Ltd., Crook, County Durham, England
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Wire Forming
Baird Machine Co., The, Stratford, Conn.
Kilmer, M. D., & Co., Cleveland, Ohio
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Wire Rope
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
Angier Corporation, The, Framingham, Mass.
Lendt & Co., Inc., New York, N. Y.
Marshall-Richards Machine Co., Ltd., Crook County Durham, England
Terkelsen Machine Co., Boston, Mass.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem, Rolling & Edging
Wean Equipment Co., Cleveland, Ohio

NAIL TOOLING—Tungsten Carbide
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Brothers, Inc., Cortland, N. Y.

NOZZLES—For Extruding Machines
Wire Tool Div., Bridgeport Jig Boring Co., Bridgeport, Conn.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Phila., Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio
Morrison Industries, Cleveland, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

OVENS—Rod Bakers
Carl-Mayer Corp., The, Cleveland, Ohio
Morrison Industries, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Morrison Industries, Cleveland, Ohio

PAINT—Acid Proof
Ceilcote Company, Cleveland, Ohio
Nukem Products Corporation, Buffalo, N. Y.

PAINT BONDING CHEMICALS—
American Chemical Paint Co., Ambler, Pa.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.
Solar Compounds Corp., Linden, N. J.

PAPER—Creped Wrapping
Angier Corporation, The, Framingham, Mass.
Terkelsen Machine Co., Boston, Mass.

PAPER—For Coil Wrapping and Corrosion Prevention
Angier Corporation, The, Framingham, Mass.
Terkelsen Machine Co., Boston, Mass.

PATENT ATTORNEYS—
Lancaster, Allwine & Rommel, Washington, D. C.

PAY-OUT SYSTEMS—(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS — (See COMPOUNDS — Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PICKLING—Hooks, etc. Acid Resisting
Youngstown Welding & Eng'g' Co., Youngstown, Ohio

PICKLING TANK LININGS—
Chemsteel Construction Co., Pittsburgh, Pa.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio
Nukem Products Corporation, Buffalo, N. Y.

PIPES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

PLASTICS—for Wire Insulation
Naugatuck Chemical Division of United States Rubber, Naugatuck, Conn.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio

PRESSES—Hydraulic and Mechanical
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Hale & Kullgren, Inc., Akron, Ohio

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio

REEL AND TENSION STANDS—
Davis Electric Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Providence, R. I.
Fidelity Machine Company, Inc., Philadelphia.
Industrial Ovens, Inc., Cleveland, Ohio
Kilmer, M. D., & Co., Cleveland, Ohio
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

Watson Machine Co., Paterson, N. J.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

EEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

EELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Milton Machine Works, Inc., Milton, Pa.

EELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

EELS—Metal Bound
Canada Reels, Ltd., Bury, Que., Canada
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
McCaskie, Inc., Wm., Westport, Mass.
North Anson Reel Co., No. Anson, Me.

EELS—Plywood
Carris Reels, Inc., Rutland, Vt.
Lavendier, Charles, Co., Inc., Pawtucket, R. I.
McCaskie, Inc., Wm., Westport, Mass.
Winchester Reel Co., Ashuelot, N. H.

EELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L. Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Mason Can Company, East Providence, R. I.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

EELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Canada Reels, Ltd., Bury, Que., Canada
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
Lavendier, Charles, Co., Inc., Pawtucket, R. I.
Mason Can Company, East Providence, R. I.
McCaskie, Inc., Wm., Westport, Mass.
Mettler Machine Tool, Inc., New Haven, Conn.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
North Anson Reel Co., No. Anson, Me.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio
Winchester Reel Co., Ashuelot, N. H.

REELS & SPOOLS—Wooden
Acrometal Products, Inc., Minneapolis, Minn.
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., Inc., The, Hazardville, Conn.
Canada Reels, Ltd., Bury, Que., Canada
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co., Pine River Minn.
Lavendier, Charles, Co., Inc., Pawtucket, R. I.
North Anson Reel Co., No. Anson, Me.
Winchester Reel Co., Ashuelot, N. H.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—(See Ovens—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Co., Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.

RODS—Wire—Non-Ferrous
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., Inc., New York, N. Y.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Company, Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
American Steel & Wire Company, Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.

RUBBERS—for Wire Insulation
Naugatuck Chemical Division of United States Rubber, Naugatuck, Conn.

RUST PROOF COMPOUNDS—
(See Compounds—Rust Preventing)

RUST REMOVING COMPOUNDS—
(See Compounds—Rust Preventing)

SALTS—Heat Treating, Descaling, etc.
Holden, A. F., Co., The, Detroit, Mich.

SATURATION SYSTEMS—
Industrial Ovens, Inc., Cleveland, Ohio
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

SOAPS—Industrial and Wire Drawing
(See Compounds—Wire Drawing)

SODIUM—for Descaling
Holden, A. F., Co., The, Detroit, Mich.

SPOOLS—(See Reels & Spools)

SPOOLS—Stamped Metal for Retail Wire Sales
Clark, J. L. Mfg. Co., Rockford, Ill.
Mason Can Co., East Providence, R. I.

STAMPINGS—Steel
Acrometal Products, Inc., Minneapolis, Minn.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Roebling's, John A. Sons Corp., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Pickling and Plating
Ceilcote Company, Cleveland, Ohio
Chemsteel Construction Co., Pittsburgh, Pa.
Nukem Products Corporation, Buffalo, N. Y.

TESTERS — INSULATION (See MACHINERY—Spark Testers)

TESTING EQUIPMENT (See MACHINERY Testing, Physical and Diameter Testing)

TINNING PROCESS—
Metal & Thermit Corp., New York, N. Y.

TINSEL—Electric Conductor
Montgomery Co., The Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper, Silver and False Gold Coated, etc. (See TINSEL—Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

TOOLS—Wire Cutting
Porter, H. K., Inc., Somerville, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRANSMISSIONS—Variable speed (See Machy—Power Transmission)

TRAVERSES & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Pressed Steel Div., Republic Steel Corp., Niles, Ohio
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

TUBE BENDERS AND FORMERS—
Kilmer, M. D., & Co., Cleveland, Ohio

VALVES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VARNISHES—for Electric Wire
N. E. Lacquer Co., E. Providence, R. I.
Solar Varnish Corporation, Linden, N. J.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

WELDERS—Spot and Butt
Ames Spot Welder Co., Brooklyn, N. Y.
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.

WIRE—Aluminum
Elmet Division, North American Philips Company, Inc., Lewiston, Maine
Malin & Co., The, Cleveland, Ohio
Seneca Wire & Manufacturing Co., Fostoria, O.

WIRE—Barbed
Gerber, J., & Co., Inc., New York, N. Y.
Interlocking Fence Co., Morton, Ill.

WIRE—Brass
Chase Brass & Copper Co., Waterbury, Conn.
Spencer Wire Corp., Union, N. J.

WIRE—Brush
Gerber, J., & Co., Inc., New York, N. Y.
Spencer Wire Corp., Union, N. J.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
American Steel & Wire Co., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., Inc., New York, N. Y.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Seneca Wire & Manufacturing Co., Fostoria, O.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Copper
Chase Brass & Copper Co., Waterbury, Conn.
Gerber, J., & Co., Inc., New York, N. Y.
Spencer Wire Corp., Union, N. J.

WIRE—Flat, Fine
Elmet Division, North American Philips Company, Inc., Lewiston, Maine
Gerber, J., & Co., Inc., New York, N. Y.
Montgomery Co., The, Windsor Locks, Conn.

WIRE—Forming
Erie Iron & Supply Corp., Erie, Pa.
Pittsburgh Cut Wire Co., Pittsburgh, Pa.

WIRE—Galvanized
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., New York, N. Y.

WIRE—Manufacturers
American Steel & Wire Co., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Continental Steel Corp., Kokomo, Ind.
Gerber, J., & Co., New York, N. Y.
Johnson Steel & Wire Co., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
National Lock Washer Company, The, Newark, N. J.
North American Philips Co., Inc., Elmet Division, Lewiston, Me.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Seneca Wire & Manufacturing Co., Fostoria, O.
Spencer Wire Corp., Union, N. J.
U. S. Steel Co., N. Y., N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Music
American Steel & Wire Co., Cleveland, Ohio
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., The, Cleveland, Ohio
Seneca Wire & Manufacturing Co., Fostoria, O.
Specialty Wire Co., Inc., Worcester, Mass.
Spencer Wire Corp., Union, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Chase Brass & Copper Co., Waterbury, Conn.
Malin & Co., The, Cleveland, Ohio

WIRE—Oil Tempered
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE—Special Shapes
Continental Steel Corp., Kokomo, Ind.
National Lock Washer Company, The, Newark, N. J.

WIRE—Spring
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., New York, N. Y.
Johnson Steel & Wire Co., Inc., Worcester.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Seneca Wire & Mfg. Co., Fostoria, Ohio
Specialty Wire Co., Inc., Worcester, Mass.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Steel & Wire Co., Cleveland, Ohio
Firth Sterling, Inc., Pittsburgh, Pa.
National Lock Washer Company, The, Newark, N. J.
Pittsburgh Steel Co., Pittsburgh, Pa.
Specialty Wire Co., Inc., Worcester, Mass.

WIRE—Steel—Also Coppered and Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., New York, N. Y.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Seneca Wire & Mfg. Co., Fostoria, Ohio
Spencer Wire Corp., Union, N. J.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting
Erie Iron & Supply Corp., Erie, Pa.
Pittsburgh Cut Wire Co., Pittsburgh, Pa.
Wickwire Brothers, Inc., Cortland, N. Y.

WIRE—Tungsten
North American Philips Co., Inc., Elmet Division, Lewiston, Me.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WRAPPING PAPER—Creped (See PAPER—Creped Wrapping)

YARNS & TAPES—
Belding Heminway, New York, N. Y.
Glass Fibers, Inc., Toledo, Ohio

YARN TESTERS—
Celanese Corporation of America, New York, N. Y.
Heineman Corp., Oscar, Chicago, Ill.
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON 3, NEW JERSEY, U. S. A.

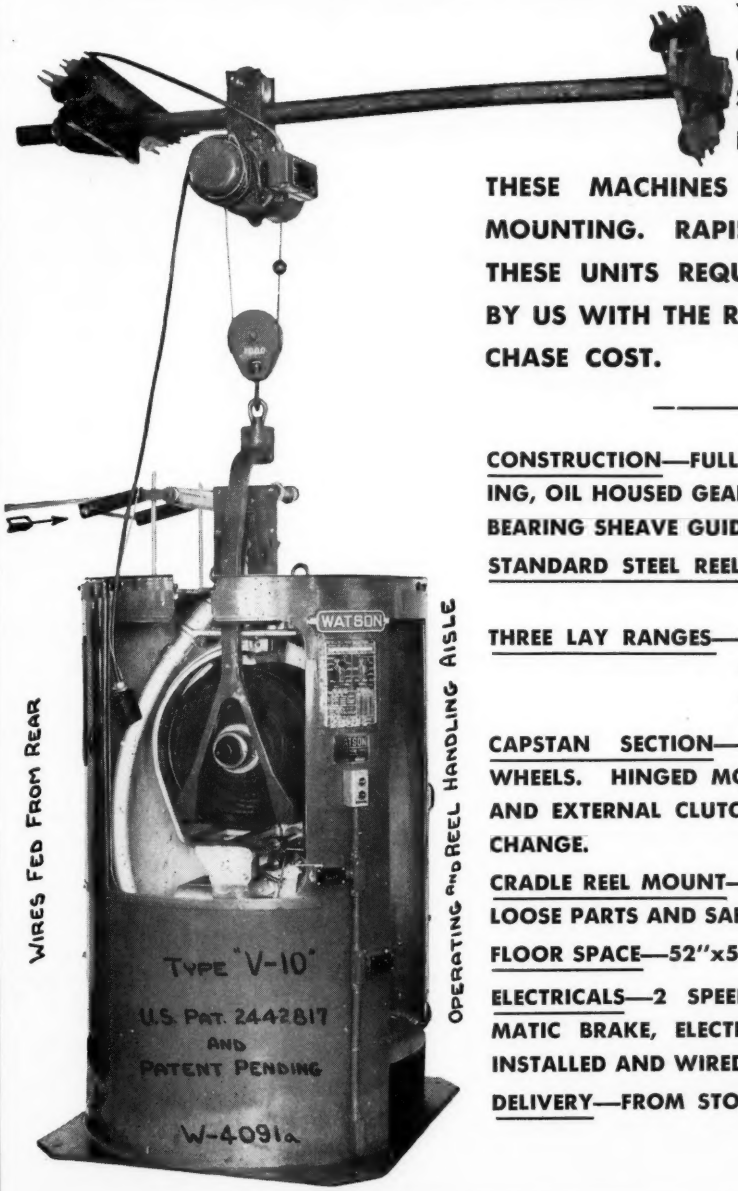
ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE
AND MASTICATING MACHINERY MANUFACTURERS

WATSON

WATSON BUNCHER "V-10"

PATENT PENDING

THESE HEAVY DUTY UNITS, DESIGNED TO MEET THE DEMAND FOR INCREASED CAPACITY AND PRODUCTION ARE NOT ONLY USED FOR FINE AND HEAVY ELECTRICAL WIRE BUNCH STRANDING, BUT ALSO FOR MANY PRODUCTS ABLE TO ABSORB TORSION, i.e., GALVANIZED STEEL CLOTHESLINE, TELEVISION GUY WIRE, PAPER AND YARN TWISTING AND BUNCH CABLING OF SMALL PLASTIC INSULATED WIRES. MINIMUM FLOOR SPACE REQUIRED MAKE THESE MACHINES IDEALLY SUITED FOR ROW MOUNTING. RAPIDLY INCREASING DEMAND FOR THESE UNITS REQUIRES QUANTITY PRODUCTION BY US WITH THE RESULTING EFFECT OF LOW PURCHASE COST.



CONSTRUCTION—FULLY GUARDED, ALL STEEL, BALL BEARING, OIL HOUSED GEARING AND SIMPLEST THREADING BALL BEARING SHEAVE GUIDES.

STANDARD STEEL REELS—No. 9—22"x11" (650-LB. CU.)
No. 10—24"x14" (1000-LB. CU.)

THREE LAY RANGES—"LOW" —.64" TO 3.21"
"STD." —.79" TO 4.02"
"HIGH"—.95" TO 4.81"

CAPSTAN SECTION—HEAVY DUTY DOUBLE GROOVED WHEELS. HINGED MOUNT SIMPLIFIES LAY GEAR CHANGE AND EXTERNAL CLUTCH SHIFT SIMPLIFIES HAND OF TWIST CHANGE.

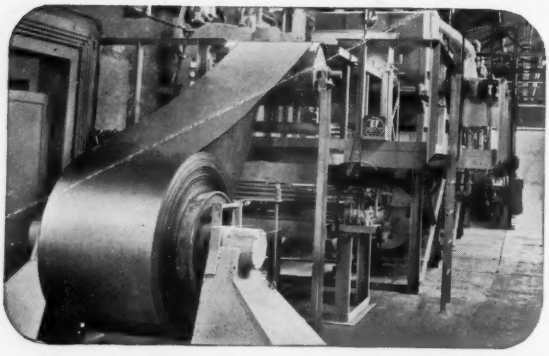
CRADLE REEL MOUNT—OVERHUNG SPINDLE TYPE WITH NO LOOSE PARTS AND SAFETY LOCK.

FLOOR SPACE—52"x59".

ELECTRICALS—2 SPEED MOTOR AND CONTROLS, AUTOMATIC BRAKE, ELECTRIC STOPS, SAFETY SWITCHES, ETC., INSTALLED AND WIRED READY TO RUN.

DELIVERY—FROM STOCK OR STOCK IN PROCESS.

10-53



EF CONTINUOUS STRIP LINES — for annealing, galvanizing, aluminizing, etc. This combination gas-fired and electric unit provides flexibility in controlled heating, soaking and cooling, for producing various surface and metallurgical conditions on ferrous and nonferrous strip. Built by The Electric Furnace Co., Salem, Ohio.

EF CONTINUOUS FURNACES are built in many sizes and types for processing wire, sheet, castings, stampings, strip, tubing and many other products. This EF gas-fired radiant tube special atmosphere furnace bright normalizes 3000 lbs. steel tubing per hour. Built by The Electric Furnace Co., Salem, Ohio.

EF builds Gas-Fired, Oil-Fired and Electric Furnaces for these and other heat treating operations

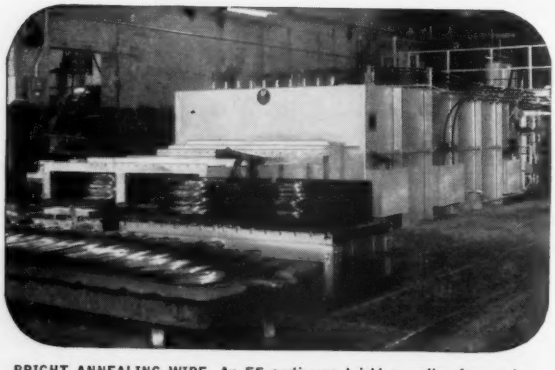
● EF engineers specialize in designing and building production furnaces — continuous and batch types — including roller hearth, roller rail, chain belt, wire belt, slot and tube conveyor types, reciprocating, rotary, car, bell, pit and other designs; complete with special atmosphere producers, and time and labor saving material handling equipment as required.

Reflecting more than 30 years of continuous research and experience, and outstanding engineering accomplishments, EF furnaces combine high heating efficiency, accurate automatically controlled cycles, and advanced designs that minimize maintenance, assure economy of operation, high hourly output and uniformity of product.

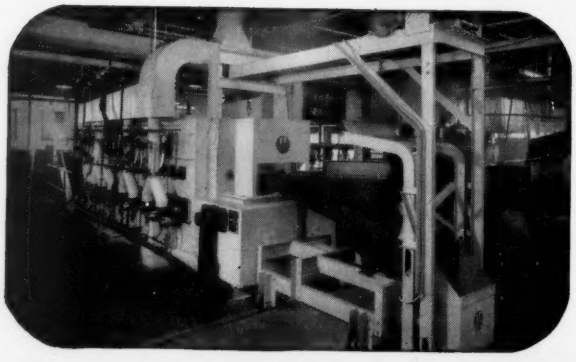
Submit your production furnace problems to ***experienced engineers — it pays.***

AGING
ANNEALING
ALUMINIZING
BRAZING
CARBON RESTORATION
CARBURIZING
CERAMIC DECORATING
DRAWING
GALVANIZING
HARDENING
HOMOGENIZING
MALLEABLIZING
NORMALIZING
NITRIDING
SINTERING
SOLUTION TREATING
SPECIAL ATMOSPHERE TREATMENTS AND OTHER PROCESSES

THE ELECTRIC FURNACE CO.
Salem - Ohio
GAS FIRED, OIL FIRED AND ELECTRIC FURNACES FOR ANY PROCESS PRODUCT OR PRODUCTION
Canadian Associates • CANEFCO LIMITED • Toronto 1, Canada



BRIGHT ANNEALING WIRE. An EF continuous bright annealing furnace in which the wire is conveyed through the various zones on two parallel rows of bulkhead type trays. This unit has convection cooling and handles 2500 net lbs. of wire per hour. Built by The Electric Furnace Co., Salem, Ohio.



HARDENING SMALL PARTS—CONTINUOUSLY. EF chain belt conveyor furnaces are unsurpassed for uniform, low cost, scale-free hardening, carbon restoration and non-decarb heat treating. 11 sizes. Capacities from 175 to 2000 lbs. per hour. Built by The Electric Furnace Co., Salem, Ohio.